

ROYAL BOTANIC GARDENS, KEW.

BULLETIN
OF
MISCELLANEOUS INFORMATION.

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I.—NOTES ON UGANDA FUNGI.

I.—THE FUNGUS-FLORA OF THE FORESTS.

T. D. MAITLAND and E. M. WAKEFIELD.

During the past two years one of us has spent some considerable time collecting and observing the fungi which occur in the forests of Uganda. The collections thus made have been deposited at Kew, where they have been supplemented by other general collections of Uganda fungi due to the energies of Mr. W. Small, Botanist in the Agricultural Department, Uganda, and of Mr. R. Dummer. The species received now number some hundreds, and although far from exhausting the mycology of the region, they appear to be fairly representative of the types of fungus flora to be found, at any rate in the Uganda Province. It has therefore seemed advisable to place on record some of the knowledge which has been acquired, the more so because, as far as we are aware, the only list of Uganda fungi previously published is that of the collection made by Scott Elliot during the Ruwenzori expedition.*

The present account deals only with those fungi, chiefly the macro-forms, which occur as saprophytes in the forests. With the exception of the few species collected by Mr. Small on Mount Elgon, the fungi enumerated all come from forests lying in the eastern part of the Uganda Province. There are other large forests in the western district which have not been touched, but their fungi are probably not strikingly different from those of the forests visited.

ECOLOGICAL NOTES.

(T. D. Maitland.)

The first collections of fungi were made in several small forests lying within the Victoria Nyanza region, north-west of Lake Victoria Nyanza. The names of these forests are Wakigu, Namamvwe, Nabaziza, Ntongo, Bumpenge, and Namutambula.

* Miss A. L. Smith in Journ. of Bot. 33, 1895, p. 340.

They lie in a semi-circle stretching from Jinja on the one hand to Entebbe on the other. It will be seen that their dispositions are not varied enough to provide extensive modifications in their vegetation, and that a description of one forest will serve for them all.

These forests, with the exception of Bumpenge, lie in valleys, and their growth is restricted to a certain area on the incline, their vegetation ceasing abruptly at the margin of the grassy land surrounding them. Each of them, including the lower region of Bumpenge, possesses a small rivulet, which eventually finds its way into the Great Lake. It is usual also to find small stretches of stagnant swamps.

Although the forests are not extensive, they contain some large timber trees which are exploited by the natives. The wild date palm (*Phoenix reclinata*) is dispersed in considerable numbers throughout these forests, as well as in the swamps and grassy lands surrounding them. The Bisu palm (*Raphia Monbuttorum*) is only sparsely distributed, but some very fine and majestic trees are to be seen. The decayed stumps of the various palms afford a good hunting ground for fungi, especially for species of *Ganoderma*.*

In each of the forests the undergrowth consists in some parts of a tangled mass of lianes and shrubby plants, in others of a short vegetation of *Scitamineae*, *Liliaceae*, and *Gramineae*.

The actual habitat of some of the fungi is striking. As already stated the larger species of *Ganoderma* occur almost always on dead palm stumps, but are by no means confined to the forests, for an abundance of these growths is found on palm stumps in farm clearings and plantations. The most conspicuous of the larger fungi of these regions belong to the *Polyporaceae*. They are found principally on loose fallen branches, in many instances lying on the top of the undergrowth. *Polyporus gilvus*, however, is usually, if not always, found on much decayed fallen tree trunks in shady positions. *Polystictus occidentalis*, a common fungus, is another exception, as when found in the forest it is usually in open airy places. Most of the specimens of this species were gathered in the open country and invariably on smooth-barked trees, such as *Albizzias*. *Polystictus sanguineus* is, one may safely say, confined to clearings and plantations, and invariably grows on the dead trunks of *Phoenix reclinata*.

There are not many striking types of *Agaricaceae* to be found, though numerous "flushes" of small species are to be seen on thoroughly rotted tree trunks in humid and densely shaded situations. Species of *Marasmius* are occasionally seen, and tangled masses of a "Horse-hair" fungus are met with amongst decayed branches of the undergrowth.

The larger *Sphaeriaceae* are well represented, and are usually found on fallen, well-decayed tree trunks in damp and shady situations. *Xylaria grammica*, *X. polymorpha*, and *Tham-*

* The same fact has been noted in Nigeria by Mr. C. O. Farquharson. (See *Kew Bull.* 1914, p. 254, and *Journ. of Bot.* 54, No. 641, May, 1916, p. 123.)

nomycetes Chamissonis are common under these conditions. They appear to be almost entirely confined to the heart-wood of dead trees, and especially hard-wooded trees, as in many cases it is well-nigh impossible to cut specimens out.

On the other hand *Hexagonia discopoda*, *Stereum lobatum* *Hymenochaete* spp. etc., prefer the bark of dead branches, while other species thrive on decayed outer wood, and yet others, as *Polystictus luteo-nitidus*, on leaf-mould. It would appear that certain fungi are suited to certain stages in the decay of wood.

The second series of forests visited run along the northern boundary of the Mawokota District. They commence at about mile 16 on the Kampala-Mubendi Road, and continue to about mile 26, but here deviate somewhat from the main road. The sections visited are known as Balisangakibugo, Tiriulire, Mwen-gizanyagi, Nakatumba, and Nakinyika, and are drained by the Mayanja and its tributaries which flow north and north-west of the Great Lake into the river Kafu.

These forests are perhaps the most striking within easy reach of Kampala, and, like most Buganda forests, nestle in a series of valleys, the afforestation being restricted to a certain area on the slopes of these valleys.

In general character they do not vary to any considerable extent from those strictly in the Victoria Nyanza region. The same undergrowth is met with—*Dracaena*, *Anomum*, *Cyperus*, lianes, and in parts a low shrub. This undergrowth is, generally speaking, not difficult to penetrate, and only when nearing the outskirts of the forest is a more tangled and denser vegetation encountered. This consists first of a thick shrubby growth, then of a mixture of Elephant Grass (*Pennisetum purpureum*), prickly *Solanums*, *Convolvulus* spp., and *Cucurbitaceae*. *Musa ensete* is also fairly common.

The forest trees are, if anything, more striking here than in the other series of forests visited. The tall white-barked trees with *Usnea*-like lichens hanging from their branches are very beautiful; likewise the giant "Mwafu," *Canarium Schweinfurthii*, with its massive arms laden with the Bird's Nest fern (*Asplenium Nidus*), *Platyserium* sp., Polypodiums, and Orchids. *Phoenix reclinata* enjoys a wide distribution both in the surrounding country and in these forests.

The fungus-flora is more or less identical with that of the forests in Kiagwe and Busiro, round the lake, since the forests are in most respects alike. Of the *Polyporaceae* the most abundant representative seen was *Polystictus aratus*. This species was plentiful on stout fallen branches and on dead branches still adhering to the tree. *Stereum lobatum* was widely dispersed, and the forms here were larger than any previously gathered. Species of *Xylaria* were also very numerous, including some very stout forms of *X. grammica*. The following fungi were also found to be widely distributed throughout these parts:—*Ganoderma lucidum*, *G. australe*, *Polystictus luteo-nitidus*, *P. flabelliformis*, *P. funalis*, *P. vinosus*, *Polyporus gilvus*, *Stereum Schomburgkii*, *Lenzites repanda*, *Lentinus infundibuliformis*, *Hydnum*, *Laschia* and *Marasmius* spp.

Nabuvumba Forest, in Busiro district, in many respects resembles Nakinyika Forest, in Mawokota, both being for the most part humid and swampy. An outstanding feature of Nakinyika Forest is the numerous *Landolphas* and fine large trees of *Canarium Schweinfurthii*.

In Bulimezi, Kangavwe Forest is rather remarkable for the huge boulders dispersed throughout, many of them moss-covered. Not many fungi of a striking character were met with there, *Fomes rimosus* being the most outstanding. In addition to those sent, *Stereum Schomburgkii*, *Polystictus obstinatus* on the edge of the forest, *Laschia Volkensii*, and several Agarics were observed. This forest covers the top of Kangavwe Hill (1274 m.) in lat. $0^{\circ}35'$ and long. $32^{\circ}20'$. The dry aspect in all probability accounts for the paucity of fungi as compared with the forests in the valleys.

The Mabira Forests, visited in September, 1915, lie within the Nile and Sezibwa River watersheds on the left bank of the Nile, and about 15 miles from the Ripon Falls, where the Nile leaves the Great Lake. They extend north to the great Sezibwa Swamp and cover an area of about 137 square miles.

Although of the same type as the forests scattered throughout the Buganda Kingdom, they are on a very much larger scale, and cover hill and dale, instead of being confined to the valleys. One outstanding feature of these forests, as compared with most others, is the wide distribution of the rubber tree *Funtumia elastica*, Stapf—a feature which has made them famous, in addition to the exploitation of the large and valuable timber trees.

Although large, these forests can be traversed with comparative ease, for the undergrowth—except where some large trees have been felled and have thus given it the advantage—is not sufficiently thick to necessitate cutting a way through. *Dracaenas* form a large part of the undergrowth, and also young seedling forest trees and lianes. Numerous paths made by animals ramify through the forest.

The climatic conditions of this large forest area differ from those of the surrounding country. The rainfall is greater and the humidity higher. Hence, with the fallen trees and branches and other decaying vegetation, conditions are very favourable for the development of a rich fungus-flora.

About 28 miles of the forest were traversed and many specimens collected which were not represented in the gatherings from other forests. Speaking generally, however, the fungus-flora is very similar to that found throughout the Victoria Nyanza Region. *Fomes rimosus* was collected here, for the first time in the Victoria Nyanza Region, and was well represented. It was found in low-lying, humid places, contrasting with its habitat in the high and dry Kangavwe Forest in Bulimezi. *Lenzites repanda* is perhaps the most abundant species, and is not confined to the forests, for it occurs abundantly on dead stumps in clearings and plantations on the outskirts. *Trametes corrugata* is also very common, but confined to the more open parts rather than to the interior. Only one specimen of *Fomes hornodermus* was found, on a live tree six feet up the trunk, but

apparently not parasitic. *Fomes pectinatus* appears to prefer lianes, occurring on both live and dead bark and roots.

Most of the forests are more or less humid at all times of the year. Agarics are perhaps slightly more in evidence in the rainy season, but on the whole the types of fungi to be met with are the same at all seasons.

SYSTEMATIC LIST.

(E. M. Wakefield.)

AGARICACEAE.

Lentinus strigosus, *Fr.* Elench. I, p. 47.

Mabira Forests, *Maitland* M 5, not common; Kampala, *Small*.

Lentinus villosus, *Kl.* in *Linnaea* VIII, 1833, p. 479.

Mabira Forests, *Maitland* M 9.

Lentinus velutinus, *Fr.* in *Linnaea* V, 1830, p. 510.

Mabira Forests, *C. B. Ussher* 55, 1908.

Lentinus blepharodes, *Berk. et Curt.* in *Journ. Linn. Soc.* X, 1869, p. 301.

Wakigu Forest, *Maitland* 7A; Kipayo, *Drummer* 1425; Mabira Forests, *Maitland* M 10.

Lentinus infundibuliformis, *Berk. et Br.* in *Journ. Linn. Soc.* XIV, 1873, p. 42.

Victoria Nyanza region, *Maitland* 58; Balisangakibugo Forest, *Maitland* 185A; Mawokota, *Small* 252; Mabira Forests, according to *Maitland* fairly common on dead stumps.

These African specimens do not quite conform to the Ceylon type. They have a coarser appearance and a more strigose surface of the pileus, but do not appear to be specifically distinct.

Lentinus exilis, *Kl. ex Berk.* in *Ann. and Mag. Nat. Hist.* III, 1839, p. 379.

Kipayo, *Dummer* 645, 1420; Mabira Forests, *Maitland* M 12, M 13 (the latter approaching *L. dactyliophorus*).

L. dactyliophorus, *Lév.* in *Ann. sci. nat. sér.* 3, vol. 2, 1844, p. 174.

Kampala, *Small* 80.

Probably only a form of *L. exilis*, distinguished by its smaller size, deeply infundibuliform shape, and more distinct ring.

Lenzites repanda, *Fr.* *Epier.* p. 404.

Common everywhere. Kampala, *Small* 56; *Dummer* 944, 2530; Victoria Nyanza region, *Maitland* 53, 60; Mubendi Road Forests, Mawokota, *Maitland*.

Schizophyllum commune, *Fr.* *Syst. Myc.* I, p. 333.

Common, *Maitland* 29, *Small* 132, *Dummer* 157.

POLYPORACEAE.

✓ **Polyporus picipes**, *Fr.* *Epier.* p. 440.

Kipayo, *Dummer* 2110; Kampala, *Maitland*; Mabira Forests, *Maitland* M 8.

All these specimens have slightly larger pores than the typical form of the species.

P. dictyopus, *Mont.* in *Ann. sci. nat. sér. 2*, vol. 3, 1835, p. 349.

Kipayo, *Dummer* 2111.

✓ **P. megaloporus**, *Mont.* in *Ann. sci. nat. sér. 4*, vol. 1, 1854, p. 124.

Nakinyika Forest, *Maitland* 131.

P. cinnamomeo-squamulosus, *P. Henn.* in *Engl. Bot. Jahrb.* 30, 1901, p. 43.

Nakinyika Forest, *Maitland* 132; Mabira Forests, *Maitland* M 26 (fairly common).

✓ **P. gilvus** (*Schw.*) *Fr.* *Elench. I*, p. 104.

Kipayo, *Dummer* 1145; Victoria Nyanza region, *Maitland*; Mubendi Road Forests, Mawokota, *Maitland*; Mabira Forests, *Maitland*.

✓ **P. anebus**, *Berk.* in *Hook. Lond. Journ. Bot.* 1847, p. 504.

Balisangakibugo Forest, *Maitland* 182.

P. pubertatis, *Lloyd*, *Syn. Sect. Apus of Polyporus*, 1915, p. 358.

Balisangakibugo Forest, *Maitland* 168, rare.

The single specimen sent agrees with the Japanese species in texture, colour of the flesh, spores, etc. It is, however, much larger than the type, more applanate, and with a more irregular, tubercular surface of the pileus.

Amauroderma sericatum, *Lloyd*, *Syn. Stipit. Polyp.*, 1912, p. 120.

Kampala, *Maitland*; Nabaziza Forest, *Maitland* 4; Kipayo, *Dummer* 2144.

This plant grows on the ground in very shady places, and is usually gregarious. It is more slender than *A. rugosum*, and is distinguished microscopically by the smooth spores and by the presence of stout brown hyphae in the pore walls. At the mouths of the pores the pointed ends of these hyphae almost form projecting setae. In the Uganda specimens the pileus is usually more zoned and less uniformly silky than in the type, but the other characters agree.

✓ **Ganoderma australe** (*Fr.*) *Pat.* in *Bull. Soc. Myc. Fr.* 1889, p. 71.

Kipayo, *Dummer* 908; Kampala, *Small* 317, 318; Mabira Forests, common, *Maitland*.

Ganoderma lucidum (Leys.) Karst. in Rev. Myc. 1881, No. 9, p. 17.

Common everywhere. Kampala, *Small* 70, 320, 319 (yellow form), *Dummer* 644; Victoria Nyanza region, *Maitland* 47; Namutambula Forest, *Maitland* 12A; Nambeya, Bulimezi, *Maitland*, 154; Mubendi Road Forests, Mawokota, and Mabira Forests, *Maitland*.

G. mastoporum, (Lév.) Pat. in Bull. Soc. Myc. Fr. 1889, p. 71.

Kipayo, *Dummer* 643.

G. fornicatum (Fr.) Pat. in Bull. Soc. Myc. Fr. 1889, p. 71. Wakigu Forest, *Maitland* 207.

Fomes senex (Nees et Mont.) Fr. Nov. Symb. p. 62.

Kampala, *Small* 248; Mubendi Road Forests, *Maitland*.

F. pectinatus (Kl.) Fr. Nov. Symb. p. 66.

Nabaziza Forest, *Maitland* 8A, on a living liane, near the base, and also on a dead stump; Nabuvumba Forest, *Maitland* 150, on a living liane, $2\frac{1}{2}$ to 3 feet from the ground, the stem being to all appearance quite healthy.

F. rimosus (Berk.) Fr. Nov. Symb. p. 66.

Kangawwe Forest, Bulimezi, *Maitland* 115; Mabira Forests, *Maitland*, on living and dead trunks.

"In Kangawwe Forest this was the most conspicuous fungus, and fairly common. It was found on dead erect trees and also on living trees, growing on the trunks at varying heights up to about 12 feet high. The scar left on the living tree when the fungus was broken off was to all appearance quite healthy, and no sign of blackening or disease was observable. The trees on which they were found had corky bark." (T. D. M.)

F. melanoporus (Mont.) Fr. Nov. Symb. p. 65.

Kipayo, *Dummer* 1465; Wakigu Forest, *Maitland* 84, 94; Balisangakibugo Forest, *Maitland* 178.

Numbers 94 and 178 are resupinate forms of the species.

F. caliginosus (Berk.) Cooke in Grevillea XIV, 1885, p. 20.

Namutambula Forest, *Maitland* 2; Wakigu Forest, *Maitland* 108; Kipayo, *Dummer* 2156A.

F. geotropus, Cooke in Grevillea XIII, 1884, p. 32.

Nambeya Forest, *Maitland* 109.

F. hornodermus (Mont.) Cooke in Grevillea XIII, 1885, p. 119.

Mabira Forests, *Maitland* M 36, on a living tree, 6 feet up the trunk, but the tree apparently quite healthy.

Polystictus luteo-nitidus (Berk.) Cooke in Grevillea XIV, 1886, p. 77.

Among leaf-mould, or attached to roots and twigs; Victoria

Nyanza region, *Maitland* 73 (unusually large and regular forms); Nakatumba Forest, *Maitland*; Kipayo, *Dummer* 2529.

✓ **Polystictus xanthopus**, *Fr.* Nov. Symb. p. 74.

Kipayo, *Dummer* 624, 1179; Victoria Nyanza region, *Maitland* 57; Mabira Forests, *Maitland*, fairly common.

✓ **P. flabelliformis** (*Kl.*) *Fr.* Nov. Symb. p. 74.

Kipayo, *Dummer* 905; Victoria Nyanza region and Mabira Forests, common, *Maitland* 45; Mubendi Road Forests, Mawokota, *Maitland*.

✓ **P. sanguineus**, *Fr.* Nov. Symb. p. 75.

Very common, especially on dead trunks of *Phoenix reclinata*. It occurs rather in the open, in clearings and plantations, than in the forests themselves. *Small*, *Maitland*, various collections.

P. mutabilis (*Berk. et Curt.*) *Cooke* in *Grevillea* XIV, 1886, p. 78.

Victoria Nyanza region, *Maitland* 75; Namutambula Forest, *Maitland* 28A; Mawokota, *Small* 158.

The Uganda forms are not quite typical. They have a thicker and more rugulose pileus than usual, and rather larger pores.

P. vernicipes (*Berk.*) *Cooke* in *Grevillea* XIV, 1886, p. 78. Namutambula Forest, *Maitland* 29A.

P. chrysites (*Berk.*) *Cooke* in *Grevillea* XIV, 1886, p. 82.

Kampala, *Small* 59.

Some very fine thick specimens. In one case a number of pilei have grown together to form a large bracket.

P. Proteus (*Berk.*) *Fr.* Nov. Symb. p. 79.

Kampala, *Small*.

P. pinsitus, *Fr.* Nov. Symb. p. 88.

Victoria Nyanza region, *Maitland* 63; Balisangakibugo Forest, *Maitland* 169.

✓ **P. versicolor** (*Linn.*) *Fr.* Nov. Symb. p. 86.

Kampala, *Small* 51.

✓ **P. hirsutus**, *Fr.* Nov. Symb. p. 86.

Kipayo, *Dummer* 2122; Mount Elgon, 1680 m., *Small* 175; Mabira Forests, *Maitland*.

P. obstinatus, *Cooke* in *Grevillea* XIV, 1886, p. 83.

Trametes obstinatus, *Cooke* in *Grevillea* XII, 1883, p. 17.

Namamvwe Forest, Victoria Nyanza region, *Maitland* 50; Balisangakibugo Forest, *Maitland*; Kangavwe Forest, Bulimezi, *Maitland*; Mabira Forests, very common in clearings, *Maitland*.

P. vittatus (*Berk.*) *Fr.* Nov. Symb. p. 86.

Kampala, on dead stumps in the open, *Maitland* 5, *Small* 52.

Polystictus vinosus (Berk.) Sacc. Syll. VI, p. 273. ✓

Kampala, *Small* 66; Kipayo, *Dummer* 1130; Namutambula Forest, *Maitland* 10A; Wakigu Forest, *Maitland* 83, Namamvwe Forest, *Maitland* 189, 190.

P. occidentalis (Kl.) Fr. Nov. Symb. p. 90. ✓

Victoria Nyanza region, *Maitland* 46, 51; Mount Elgon, 1680 m., *Small* 176; Mabira Forests, very common in clearings, *Maitland*.

P. lanatus, Fr. Nov. Symb. p. 90.

Kampala, *Small* 72.

P. aratus (Berk.) Cooke in Grevillea XIV, p. 86. ✓

Polyporus luteo-olivaceus, Berk. et Br. in Trans. Linn. Soc., 2 ser., I, 1880, p. 402.

Very common everywhere. Victoria Nyanza region, *Maitland* 66; Bumpenge and Namutambula Forests, *Maitland* 3A, 16A; Wakigu Forest, *Maitland* 92; Balisangakibugo Forest, *Maitland* 167A; Nakinyika Forest, *Maitland* 125A; Kangavwe Forest, Bulimezi, *Maitland* 125; Namamvwe Forest, *Maitland* 167B; Kipayo, *Dummer* 907; Kasala Forest, *Dummer* 2360; Kampala, *Small* 67, 73, 75; Mabira Forests, *Maitland*.

The species is as variable as it is common. When young the pileus is rather rigid, the pores regular, and covered with a glaucous bloom. In old specimens, however, the pileus becomes more flexible, being frequently much eaten by insects, the pores become longer and the openings irregular, while the glaucous deposit disappears, leaving the hymenium of a dark olive-brown colour. Stalked forms are not infrequent, the stalk being in some cases as much as 2 in. long.

P. caperatus (Berk.) Fr. Nov. Symb. p. 92. ✓

Wakigu Forest, *Maitland* 91, 93, 98, 101; Bumpenge Forest, *Maitland* 107; Mabira Forests, *Maitland* M 28.

The specimens vary very greatly in size and thickness, and also in the development of the tomentum of the pileus. The following species appears to be probably only a form with larger and more irregular pores.

P. Fischeri, P. Henn. in Engl. Bot. Jahrb. 23, 1897, p. 546.

Wakigu Forest, *Maitland* 90, 100; Kipayo, *Dummer* 2117.

P. tabacinus (Mont.) Fr. Nov. Symb. p. 93.

Nabuvumba Forest, *Maitland* 148.

P. beharensis (Berk.) Cooke in Grevillea XIV, 1886, p. 87.

Mubendi Road, Kampala, *Maitland* 146.

Trametes corrugata (Pers.) Bres. in Hedwigia, vol. 51, 1912, p. 316. ✓

Polystictus Persoonii, Fr. ex Cooke in Grevillea XIV, 1886, p. 85.

Victoria Nyanza region, *Maitland* 52; Mabira Forests, common

on dead stumps in the open, *Maitland*; Kampala, *Small*, *Maitland*; Nambeya Forest, *Maitland*.

It is curious that the Uganda forms are all very thick, some of them being almost hoof-shaped. They are, moreover, for the most part entirely white, though the characteristic dark red stain was observed at the base of the pileus in a few instances. The usual thin form with a well-developed, reddish pileus does not appear, however, to occur in this region.

Trametes cingulata, Berk. in Hook. Journ. Bot. 1854, p. 164. Kipayo, *Dummer* 2531.

Hexagonia Miquelii (Mont.) Sacc. Syll. VI, p. 361.

Victoria Nyanza region, *Maitland* 72, pro parte; Mukono Forest, rare, *Dummer* 2354; Kipayo, rare, *Dummer* 2523; Mabira Forests, sparsely distributed, *Maitland*.

H. discopoda, Pat. et Har. in Bull. Soc. Myc. Fr. IX, 1893, p. 209.

Kampala, *Small* 74; Kipayo, *Dummer* 1142; Victoria Nyanza region, *Maitland* 74A; Mount Elgon, 1525 m., *Small* 162; Mabira Forests, sparsely distributed, *Maitland*.

The species is not aptly named, for it is more frequently sessile than stipitate. It is common in tropical Africa, and easily recognised by the dark reddish stain at the base of the pileus.

H. velutina, Pat. et Har. in Bull. Soc. Myc. Fr. IX, 1893, p. 209.

Kipayo, *Dummer* 904; Mabira Forests, common on dead tree trunks and stumps, *Maitland*.

H. atro-sanguinea, P. Henn. in Engl. Bot. Jahrb. 23, 1897, p. 545.

Nabaziza Forest, *Maitland* 25A; Kipayo, *Dummer* 2367.

Favulus brasiliensis, Fr. Elench. I, p. 44.

Victoria Nyanza region, *Maitland* 36; Mount Elgon, 1370 m., on the dead wood of a bridge, *Small* 177; Kabulamuliro, Singo, on dead branches of *Phoenix reclinata* in the open, *Maitland* 121.

Laschia Volkensii, Bres. apud Henn. in Engler, Pflanzenwelt Ostafrikas, Teil C, p. 58.

Victoria Nyanza region, *Maitland* 79; Mawokota, *Small* 156, 255; Bumpenge Forest, *Maitland* 32A; Kangavwe Forest, Bulimezi, *Maitland*; Mabira Forests, common, *Maitland*.

HYDNACEAE.

Hydnum reniforme, Berk. et Curt. in Journ. Linn. Soc. X, 1869, p. 325.

Wakigu Forest, *Maitland* 105.

Hydnum glabrescens, *Berk. et Rav.* in *Grevillea*, I, 1873, p. 97, and in *Journ. Linn. Soc.* XIV, 1873, p. 59.

Victoria Nyanza region, *Maitland* 77; Mubendi road Forests, *Maitland*.

H. cinnabarinum (*Schw.*) *Fr.*, *Elench.* p. 137.

Kipayo, *Dummer* 622.

This may be only a state of *Polystictus sanguineus*, but the form is quite worthy of record. The habit is exactly that of a resupinate *Hydnum* (*Acia*).

Irpex durescens (*Cooke*) *Sacc.* *Syll.* VI, p. 485.

Wakigu Forest, *Maitland* 85; Nabaziza Forest, *Maitland* 209; Kijude, *Dummer* 2522.

I. flavus, *Kl.* in *Linnaea* VIII, 1833, p. 488.

Kipayo, *Dummer* 2139.

Grandinia rosea, *P. Henn.* in *Engl. Bot. Jahrb.* 38, 1905, p. 108.

Wakigu Forest, *Maitland* 89.

Caldesiella Duemmeri, *Wakefield*, in *Kew Bull.* No. 3, 1916, p. 73.

Kipayo, *Dummer* 635.

Mucronella calva, *Fr.* *Hym. Eur.* p. 629.

Kipayo, *Dummer* 1172.

THELEPHORACEAE.

Cladoderis infundibuliformis (*Kl.*) *Fr.* *Fung. Natal.* p. 141.

Namutambula Forest, on a decayed stump of *Phoenix reclinata*, *Maitland* 1; Nabaziza Forest, *Maitland* 30A; Kipayo, *Dummer* 2108; Mabira Forests, not very abundant, usually on thick fallen branches, *Maitland*.

Cyphella fulvo-disca, *Cooke et Mass.* in *Grevillea* XVIII, 1890, p. 50, and in *Hedwigia* 29, 1890, p. 67.

Kipayo, *Dummer* 1157.

Stereum elegans (*Mey.*) *Fr.* *Epier.* p. 545.

Kipayo, *Dummer* 2300; Mawokota, *Small* 253; Mabira Forests, on a dead stump which had rotted to the ground level, *Maitland* M2.

S. affine, *Lév.* in *Ann. sci. nat. sér.* 3, 2, 1844, p. 210.

Mawokota, *Small* 257; Kipayo, *Dummer* 626.

S. nitidulum, *Berk.* in *Hook. Journ. Bot.* 1843, p. 638.

Victoria Nyanza region, *Maitland* 80.

Stereum involutum, Kl. ex Fr. Epicr. p. 546.

Bumpenge Forest, on dead branches in an open part of the forest, *Maitland* 33A.

S. australe, Lloyd, Letter No. 48, 1913, p. 10.

Wakigu Forest, *Maitland* 151; Kipayo, *Dummer* 906.

S. bicolor (Pers.) Fr. Epicr. p. 549.

Kampala, *Small* 57; Victoria Nyanza region, *Maitland* 37, 44, 82.

S. lobatum, Fr. Epicr. p. 547.

Kampala, *Small* 76; Victoria Nyanza region, *Maitland* 62; Kipayo, *Dummer* 624 (pro parte), 2310; Mubendi Road Forests, *Maitland* (very large specimens); Mabira Forests, common on thick dead branches, *Maitland*.

S. rimosum, Berk. in Hook. Journ. Bot. 1851, p. 169.

Nabaziza Forest, *Maitland* 19A.

S. Schomburgkii, Berk. in Journ. Linn. Soc. XIII, 1873, p. 168.

Kipayo, *Dummer* 945, 1133; Bumpenge Forest, *Maitland* 34A; Mubendi Road Forests, *Maitland*; Kangavwe Forest, Bulimezi, *Maitland*; Mabira Forests, *Maitland*.

S. annosum, Berk. et Br. in Journ. Linn. Soc. XIV, 1873, p. 67.

Nakinyika Forest, *Maitland* 127; Balisangakibugo Forest, *Maitland* 186.

This species is very closely allied to *S. frustulosum*, and might be considered as a variety of that plant, differing chiefly in the pileate habit. The best developed specimens are broadly effused, with a distinct reflexed pileus up to 2 cm. in width. The cystidia are like those of *S. frustulosum*, and the species differs from *S. subpileatum* in this character, as well as in the smooth pileus. The effect on the wood is similar to that of *S. frustulosum* and *S. subpileatum*.*

S. albo-cinctum, Berk. et Br. in Journ. Linn. Soc. XIV, 1873, p. 66.

Kipayo, *Dummer* 2114.

The species is near to *S. induratum*, Berk., but is entirely resupinate, whereas the type specimen of that species is pileate. Both *S. induratum* and *S. albo-cinctum* are distinguished from *S. duriusculum* by the thick, cinnamon-brown flesh.

S. umbrinum, Berk. et Curt. in Grevillea I, 1873, p. 164.

For synonymy see *Kew Bull.* No. 8, 1915, p. 369.

Kipayo, on *Sapium Mannianum*, *Dummer* 1159; Ntongo, Busiro, on a dead erect stump of *Phoenix reclinata*, *Maitland* 194, (a pale form).

* Cfr. Long in Journ. Agr. Res. v. 1915, p. 421.

Hymenochaete luteo-badia (Fr.) Wakefield, comb. nov.

Stereum luteo-badium, Fr. Epier. p. 547. *Thelephora Kunzeii*, Hook. in Bot. Misc. II, 1831, p. 163. *Hymenochaete Kunzeii*, Mass. in Journ. Linn. Soc. XXVII, 1890, p. 100.

Victoria Nyanza region, *Maitland* 71; Kipayo, *Dummer* 1452; Mabira Forests, *Maitland* M17.

H. cervina, Berk. et Curt. in Grevillea I, 1873, p. 165.

Mount Elgon, 1220 m., *Small* 227.

H. tristicula (Berk. et Br.) Mass. in Journ. Linn. Soc. XXVII, 1890, p. 111.

For synonymy see *Kew Bull.* No. 3, 1916, p. 73.

Very common on fallen twigs and branches. Victoria Nyanza region, *Maitland* 25; Kangavwe Forest, *Maitland* 119; Nakinyika Forest, *Maitland* 138; Mwengizanyagi Forest, Mawokota, *Maitland* 202; Mabira Forests, *Maitland* M30.

Peniophora cinerea (Fr.) Cooke in Grevillea VIII, 1879, p. 20. Kampala, on the bark of *Acacia* sp., *Maitland* 198.

P. occidentalis, Ell. et Ev. in Bull. Torr. Bot. Cl. XXIV, 1897, p. 277.

Kangavwe Forest, Bulimezi, *Maitland* 114.

Cystidia large, thick-walled, pointed, encrusted with crystals in the upper part, sunken or emerging, up to 175 μ long, 20-30 μ wide. Spores cylindrical, 13-14 \times 6 μ .

P. radicata (P. Henn.) v. Hoehn. et Litsch. in Sitzber. k. Akad. d. Wissensch. Wien, CXVII, 1, 1908, p. 1092.

Kipayo, *Dummer* 636.

Asterostromella sp.

Nakatumba Forest, *Maitland* 205.

The species is near to *A. investiens*, but darker in colour. The specimens are unfortunately sterile.

CLAVARIACEAE.

Pterula importata, P. Henn. in Verh. Bot. Ver. Prov. Brandenburg. XL, 1898, p. 121.

Kipayo, *Dummer* 1185.

Lachnocladium Zenkeri, P. Henn. in Engl. Bot. Jahrb. XXX, 1901, p. 42.

Kipayo, *Dummer* 929, 2146; Balisangakibugo Forest, *Maitland* 176.

The plant is white when young, but turns to a fleshy colour when old. It is common in most forests and at most times of the year (*Maitland*).

TREMELLACEAE.

Auricularia tremellosa (Fr.) Petch in Ann. Roy. Bot. Gard. Peradeniya. Vol. IV. 1910, p. 414. Cfr. also Patouillard in Journ. de Bot. I, 1887, p. 226.

Mount Elgon, 1220 m., *Small* 145.

Hirneola ampla (*Pers.*) *Fr.* Fung. Nat. p. 146.

Mubendi, 1220 m. *Small* 321.

This species is thinner, paler, and less woolly on the surface of the pileus than *H. polytricha*. The specimens are preserved in spirit and in that medium appear almost whitish.

H. polytricha (*Mont.*) *Fr.* Fung. Nat. p. 146.

Kipayo *Dummer* 1131; Victoria Nyanza region, *Maitland* 34; Mount Elgon, *Small* 146, 150, 157.

H. Auricula-Judae (*Linn.*) *Berk.* Outl. 1860, p. 289.

Kipayo, *Dummer* 613.

Tremella fuciformis, *Berk.* in Hook. Journ. Bot. 1856, p. 277.

Kipayo, *Dummer* 930.

T. mesenterica, *Retz.* in Vet. Akad. Handl. 1769, p. 249.

Mount Elgon, 1370 m. *Small* 144.

Guepinia spathularia (*Schw.*) *Fr.* Elench. II, p. 32.

Kipayo, *Dummer* 640; Kampala, on dead wood of *Phoenix reclinata*, *Small* 297, 301.

Calocera furcata, *Fr.* Syst. Myc. I, p. 486.

Kipayo, on dead stems of *Phoenix reclinata*, *Dummer* 1177.

GASTEROMYCETACEAE.

Dictyophora indusiata, *Fischer* in Sarasin et Roux, Nova Caledonia, Vol. I, part 1, 1914, p. 3.

Nabuvumba Forest, the "egg" stage only, on a well-decayed stump in a very dark position, *Maitland* 153.

Cyathus limbatus, *Tul.* in Ann. sci. nat. sér. 3, vol. 1, 1844, p. 78.

Kipayo, *Dummer* 614.

C. Poeppigii, *Tul.* in Ann. sci. nat. sér. 3, vol. 1, 1844, p. 77.

Mount Elgon, 1370 m., *Small* 143; Kipayo, *Dummer* 2112.

Geaster mirabilis, *Mont.* in Ann. sci. nat. sér. 4, vol. 3, 1855, p. 139.

Kipayo, *Dummer* 1462.

G. velutinus, *Morg.* in Journ. Cinc. Nat. Hist. Soc. XVIII. 1895, p. 38.

Namamvwe Forest, *Maitland* 81; Kipayo, *Dummer* 1419, 1424.

Calvatia lilacina (*Mont. et Berk.*) *Lloyd*, Lycoperdaceae of Australia, 1905, p. 35.

Mabira Forests, *Maitland* M 38.

SPHAERIACEAE.

Gibbera guaranitica, *Speg.* Fung. guaran., Pug. 1, 1883, p. 91.

Mubendi Road Forests, *Maitland* 213; Kipayo, on dead stems of *Phoenix reclinata*, *Dummer* 2152.

Rosellinia emergens (*Berk. et Br.*) *Sacc.* Syll. I, p. 257.

Kampala, *Small* 62, 313; Mawokota, *Small* 164; Wakigu Forest, *Maitland* 208.

R. subiculata (*Schw.*) *Sacc.* Syll. I, p. 255.

Kampala, *Small* 78.

The spores are slightly smaller than in the type.

Xylaria polymorpha (*Pers.*) *Grev.* Flor. Edin. p. 35.

Victoria Nyanza region, *Maitland* 69; Mubendi Road Forests, Mawokota, *Maitland*; Kampala, *Small* 140, 308.

X. nigripes (*Kl.*) *Sacc.* Syll. IX, p. 527.

Kirerema, in a termite nest, sclerotia only, *Maitland* M 37.

X. grammica, *Mont.* in Ann. sci. nat. sér. 2, vol. 13, 1840, p. 341.

Victoria Nyanza region, *Maitland* 64, 67; Mawokota, *Small*, 159, 160, 161; Nabaziza Forest, *Maitland*; Mabira Forests, common, *Maitland*.

X. plebeja, *Ces. Mycet.* Born. 1879, p. 16.

Victoria Nyanza region, *Maitland* 27; Mawokota, *Small* 262.

X. anisopleura, *Mont.* in Ann. sci. nat. sér. 2, vol. 13, 1840, p. 348.

Kampala, *Small* 289; Kipayo, *Dummer* 1438.

X. involuta, *Kl. ex Cooke* in *Grevillea* XI, 1883, p. 82.

Kipayo, *Dummer* 2153; Mubendi Road Forests, *Maitland* 175.

X. Thwaitesii, *Berk. et Cooke* in *Grevillea* XII, 1883, p. 1.

Mabira Forests, *Maitland* M 21.

X. rhopaloides, *Mont.* in Ann. sci. nat. sér. 4, vol. 3, 1855, p. 99.

Victoria Nyanza region, *Maitland*, 33; Mawokota, *Small* 260.

X. pallida, *Berk. et Cooke* in Journ. Linn. Soc. XV, 1876, p. 395.

Nakinyika Forest, *Maitland* 135.

X. corniformis, *Fr.* Summ. Veg. Scand. p. 381.

Namamvwe Forest, *Maitland* 193.

X. Hypoxylon, *Grev.* Flor. Edin. p. 355.

Victoria Nyanza region, *Maitland* 32; Mubendi Road Forests, *Maitland* 119.

These specimens have slightly smaller spores than usual.

Xylaria Hypoxylon, forma tropica, *Theiss.* Xylariaceae
Austro-brasil. 1909, p. 8.
Namamvwe Forest, *Maitland* 191.

X. flabelliformis (*Schw.*) *Berk. et Curt.* in Journ. Linn. Soc.
X, 1869, p. 381.
Mawokota, *Small* 254; Kipayo, *Dummer* 2365.

X. arbuscula, *Sacc.* in *Michelia* I, 1878, p. 249.
Nagunga, *Dummer* 1439.

X. ianthino-velutina, *Mont.* in Ann. sci. nat. sér. 2, vol. 13,
1840, p. 348.

Nambeya Forest, *Maitland* 117, 118; Nakinyika Forest, *Maitland* 117A; Nakatumba Forest, *Maitland* 200; Mabira Forests, *Maitland* M 29.

The species is common in most of the forests visited, and always occurs on fallen seed-vessels.

X. Kurziana, *Currey* in Trans. Linn. Soc. ser. 2, 1, 1876, p. 129.
Victoria Nyanza region, *Maitland* 28.

Thamnomycetes Chamissonis, *Ehrenb.* in Horae Physic. Berol.
1820, p. 79.

Victoria Nyanza region, *Maitland* 76; Kipayo, *Dummer* 2368;
Mabira Forests, sparsely distributed, *Maitland*.

Camillea africana, *Wakefield* in Kew Bull. No. 3, 1916, p. 74.
Kampala, *Small* 137; Kipayo, *Dummer* 2364.

Ustulina zonata (*Lév.*) *Sacc.* Syll. I, p. 352.
Mount Elgon, *Small* 136, 215; Namamvwe Forest, *Maitland*
192; Kipayo, *Dummer* 1453.

Sarcoxylon aurantiacum, *Pat.* in Bull. Soc. Myc. Fr. 27,
1911, p. 331.
Balisangakibugo Forest, *Maitland* 195; Kipayo, *Dummer* 1443.

Daldinia concentrica, *Ces. et De Not.* in Comm. Soc. Critt.
It. No. 4, 1863, p. 198.
Kampala, *Small* 55.

D. Eschscholtzii (*Ehrenb.*) *Rehm* in Ann. Myc. II, 1904,
p. 175.

D. concentrica, var. *microspora* (*Starb.*) *Theiss.* in Ann. Myc.
VII, 1907, p. 3.

Bumpenge Forest, *Maitland* 23A; Kipayo, *Dummer* 1442;
Mabira Forests, common, *Maitland* M23.

The constant association of small spores with the conspicuous copper-coloured or purplish incrustation on the surface, and very light weight, appears to be a distinction worthy of specific rank.

Hypoxylon annulatum (Schw.) Mont. in Gay, Hist. de Chile, Bot. VII, 1850, p. 445.

Kangavwe Forest, Bulimezi, *Maitland* 112.

H. anthochroum, Berk. et Br. in Journ. Linn. Soc. XIV, 1873, p. 122.

Mubendi Road Forests, *Maitland* 145.

H. anthracodes (Fr.) Sacc. Syll. I, p. 365.

Nakinyika Forest, *Maitland* 124.

H. Malleolus, Berk. et Rav. in Grevillea IV, 1875, p. 49.

Wakigu Forest, *Maitland* 96; Kampala, *Small* 61; Mubendi Road Forests, *Maitland* 130.

H. microcarpum, Penz. et Sacc. in Malpighia XI, 1897, p. 492.

Nakinyika Forest, *Maitland* 126.

H. multiforme, Fr. Summ. Veg. Scand., p. 384.

Balisangakibugo Forest, *Maitland* 172; Mabira Forests, *Maitland* M 33.

H. quisquiliare, Mont. in Ann. sci. nat. sér. 2, vol. 14, 1840, p. 2, 321.

Kipayo, *Dummer* 2155.

H. rubiginosum, Fr. Summ. Veg. Scand., p. 384.

Kampala, *Small* 60; Kangavwe Forest, *Maitland* 113; Kipayo, *Dummer* 1449; Mabira Forests, *Maitland*.

H. stigmoideum, Ces. Mycet. Born. 1879, p. 17.

Victoria Nyanza region, *Maitland* 72 (pro parte).

Kretzschmaria cetrarioides (Welw. et Curr.) Sacc. Syll. IX, p. 567.

Mawokota, *Small* 163.

K. coenopus (Mont.) Sacc. Syll. IX, p. 565.

Kampala, *Small* 81; Victoria Nyanza region, *Maitland* 68.

HYPOCREACEAE.

Nectria ochroleuca (Schw.) Berk. in Grevillea IV, 1875, p. 16.

Kipayo, on decaying *Piptadenia africana*, *Dummer* 1431.

N. episphaeria (Tode) Fr. Summ. Veg. Scand. p. 388.

Mabira Forests, *Maitland* M 34.

N. Rickii, Rehm, in Hedwigia XLIV, 1904, p. 2.

Kipayo, *Dummer* 629, on *Ustulina zonata*.

This is a form with slightly longer spores, $7.5-8 \times 4 \mu$. The same form, and on the same host, was collected by von Höhnelt in Java. The species differs from *N. episphaeria* in the pale-coloured spores, with rough walls.

Nectria haematococca, *Berk. et Br.* in Journ. Linn. Soc. XIV, 1873, p. 116.

Mount Elgon, *Small* 134.

Hypocrea subcitrina, *Kalchbr. et Cooke* in Grevillea IX, 1880, p. 26.

Mubendi Road Forests, *Maitland* 143.

H. insignis, *Berk. et Curt.* in Journ. Linn. Soc. X, 1869, p. 376.

Mabira Forests, *Maitland* M 22.

The spores are minute, hyaline, oblong or subglobose, $2\ \mu$ diam., or $2-2\frac{1}{2} \times 1\frac{1}{2}-2\ \mu$. A few asci with similar spores have been found in the type.

H. gelatinosa (*Tode*) *Fr.* Summ. Veg. Scand., p. 383.

Mabira Forests, *Maitland* M 4.

HYSTERIACEAE.

Tryblidiella rufula (*Spreng.*) *Sacc.*, Syll. II, p. 757.

Kipayo, on *Eugenia*, sp., *Dummer*, 1138.

DISCOMYCETES.

Cookeina Colensoi (*Berk.*) *Seaver* in Mycologia V, 1913, p. 191.

Sarcoscypha Colensoi, *Sacc.* Syll. VIII, p. 157.

Geopyxis aluticolor, *Sacc.* Syll. VIII, p. 64.

Nakinyika Forest, *Maitland* 142.

Ciliaria scutellata (*Linn.*) *Boud.* in Bull. Soc. Myc. Fr. I, 1885, p. 105.

Kipayo, *Dummer* 1134.

Orbilbia xanthostigma, *Fr.* Summ. Veg. Scand., p. 357.

Kipayo, *Dummer* 1136.

HYPHOMYCETES.

Trichoderma lignorum (*Tode*) *Harz* in Bull. Soc. Imper. Moscou, XLIV, 1871, part 1, p. 116.

Kampala, *Small* 131.

Trichothecium roseum (*Pers.*) *Link.* Observat. I, p. 18.

Kipayo, *Dummer* 1198.

Rhinotrichum Curtisii, *Berk.* in Grevillea III, 1875, p. 108.

Kasala Forest, *Dummer* 1418.

Helminthosporium gigasporum, *Berk. et Br.* in Journ. Linn. Soc. XIV, 1873, p. 98.

Mabira Forests, *Maitland* M 18.

Isaria Sphingum, Schw. Syn. Fung. Carol. 1822, p. 100.
Kipayo, on a moth, *Dummer* 1137.

I. congesta, Berk. et Br. in Journ. Linn. Soc. XIV, 1873,
p. 96.
Kipayo, *Dummer* 1173; Mount Elgon, *Small* 240.

I. acervata, Massee in *Kew Bull.* 1901, p. 167.
Kipayo, *Dummer* 1175, 1429.

II.—SEED SELECTION IN THE CULTIVATION OF *HEVEA BRASILIENSIS*.

CLAYTON BEADLE and HENRY P. STEVENS.

Our attention was recently drawn by the Director of the Royal Botanic Gardens, Kew, to the probable importance of seed selection in the cultivation of *Hevea brasiliensis*. He pointed out the large increase in the yield of alkaloids from cinchona bark which has been obtained as the result of seed selection, and suggested that important results might similarly be obtained in the cultivation of *Hevea brasiliensis*.

In June last we addressed a letter on this subject to the Rubber Growers' Association, which has been submitted to Messrs. Morgan, Marsden and Reeve, the Association's resident scientific officers in the East. We give below the substance of our original letter, together with a digest of their views:—

In the cultivation of cinchona the yield of quinine from the bark has been raised from about 3 per cent. to 7 per cent. or more as the result of planting from the seed of trees whose bark yielded a high percentage of alkaloids. Can a similar method of seed selection be applied to increase the yield of rubber?

The matter, however, is not so simple in the case of Para rubber as in the case of cinchona. In the latter, the analysis of the bark reveals the percentage of alkaloids, but in the case of Para rubber it would be necessary to keep daily records of the yields of individual trees over some considerable period before it could be said with certainty whether the trees were good or poor milkers. Work of this nature would have to be undertaken as a preliminary to seed selection, as there seems to be some doubt as to how far trees fluctuate in their yields over relatively long periods. We were informed by one planter of experience that a tree which was yielding poorly might be yielding well in a few months' time and, similarly, trees which appeared to be yielding large quantities of latex might, in the course of a few months, be found to be yielding quite small quantities. We have not had an opportunity of obtaining figures over a sufficiently long period.

Having ascertained definitely that trees vary in yield, it will then be necessary to devise means for selecting seeds from good milkers and avoiding those from poor milkers. This matter is more difficult in the case of a rubber tree than in the case of

cinchona. The cinchona produces a large number of small seeds, and consequently there is no difficulty in obtaining ample seed from a few trees, sufficient for planting up large areas. The bark gives a good yield of alkaloids when the tree is four years old and, although the percentage yield increases slowly over the next few years, the increase is small and regular, so that an examination of the bark of four-year-old trees is sufficient to determine their value as producers of alkaloids. On the other hand, *Hevea* produces a relatively small number of large seeds. Moreover, the bursting of the capsule by which these seeds become scattered makes it practically impossible to collect seeds from any particular tree*. There is also the question of cross-fertilisation, as, even if the seeds be taken from good milkers, they may have been pollinated from trees which are poor milkers.

The points which require elucidation are:—

1. To ascertain if trees can be classified as good and poor milkers.
2. To ascertain which trees are good milkers.
3. To collect seeds from particular trees.
4. To avoid cross-fertilisation between good and poor milkers.
5. Assuming that both male and female elements be derived from good milkers, there would probably be poor milkers among the ancestry. This would produce throw-backs, which might necessitate selection over another generation.

The necessary procedure would appear to be either:—

(a) To plant up a small area surrounded by jungle so as to isolate the trees in the area from those of the plantation, or:—

(b) To select a small area on an estate which is separate from other parts of the estate, and proceed to keep a record of the daily yields of the dry rubber from the trees of this area. As it becomes apparent that certain of these trees are poor milkers, they should be cut out until eventually the trees on this area consist of good milkers only.

If, as under (a), the trees have to be planted up on a fresh area, it will be seven or eight years before the poor milkers can be eradicated. If, however, an area already planted up should be found sufficiently isolated from the main part of the plantation to prevent the possibility of cross-fertilisation, a couple of years would probably suffice to ascertain which are the poor milkers and to cut them out.

The seeds now produced in this area will be entirely from good milkers. They will produce trees, the majority of which will be good milkers, although a few of them, in accordance with (5), may be throw-backs, and consequently poor milkers. However, the seeds from this area should be a vast improvement on seeds collected at random on an estate. Having carried the procedure so far, it would be well worth while to make a further selection by planting up a new area separated by a broad jungle belt from other *Hevea* trees, and again to proceed regularly to record the

* This difficulty might be overcome by cutting of seed-bearing branches just before the seed is fully ripe.

yields, eventually cutting out the poor milkers that will probably be found among them. In this manner seeds will be available which should produce practically nothing but good milkers.

There is, perhaps, an alternative to the first part of the procedure we have outlined, namely, the propagation of trees by means of cuttings. This is possible, and if found practicable the small area to be planted up for seed production could be furnished with good milkers grown directly from cuttings from the best milkers on the plantation.

The preliminary work carried out to distinguish between good and poor milkers may result in some simpler means being discovered by which either may be recognised. The investigation would be well worth undertaking from this point of view alone, as it would be of much benefit by enabling poor milkers to be cut out in the process of thinning out.

The matter, however, is one on which advice should be obtained from your botanists. We cannot profess to more than a general idea of the problem involved and the methods to be employed. We have, however, thought it worth while to bring the matter to your notice as we consider it to be of prime importance to the industry.

It is to be regretted that research of this description was not undertaken years ago by the Government Agricultural Departments in Ceylon or Malaya, as an ample supply of the best strain of seed would now have been available for planting purposes.

It should also be noted that deterioration in latex yields from newly-planted areas as compared with older areas is not only possible but, regarded from some standpoints, even probable. Thus, it is found that the cinchona trees which yield the smallest proportion of alkaloids from their bark produce abundance of seed, while exactly those trees which give the highest percentage of alkaloids are shy of fruiting. If it is possible to draw the parallel conclusion in the case of rubber trees, it follows that the present method of seed selection must result in a gradual deterioration of the rubber-yielding capacity of the tree for, by taking the seeds at random, a larger proportion of seeds from the prolific fruiting trees will be obtained, and these trees are just those which may be the poorest milkers.

Having now reviewed the matter, we will consider the various points in the order in which they have been raised:—

(1) To ascertain if there is an appreciable variation in the yields of individual trees over long periods. Messrs. Morgan and Marsden are agreed that no attempt has been made to obtain reliable data as to the variation in yield of latex and rubber from individual trees, nor is anything known for certain as to the regularity in yield over a long period. Mr. Morgan writes: "All planters are fairly sure that some trees are better yielders than others at all times," but also agrees that "yields may fluctuate." Mr. Marsden is also of the opinion that certain trees "do yield well consistently whilst from others the flow is always scanty." Both Messrs. Morgan and Marsden draw attention to

the occasional heavy yields from individual trees and suggest that such yields may be due to disease, especially canker, which, according to Mr. Marsden, in the early stages of attack stimulates the latex flow. In any series of experiments it is therefore necessary to examine the trees carefully to see that they are healthy.

(2) It being admitted that a variation exists to determine how a classification of good and poor milkers can be made. Mr. Marsden states that good milking trees are known, but that for strict work it would be best to take the quantity and quality of latex figures for at least a year. It is certain that planters believe they can distinguish between good and poor milkers as on this depends the selection of trees in thinning out. Mr. Marsden states that good milkers are characterised by "(1) fewness of seed pods, and (2) late wintering." If this be so, there would appear to exist the same relationship between yields of rubber and seed in *Hevea* as has been found to exist between yields of alkaloid and seed in *Cinchona*, and the same conclusion must apply, that is to say, with the present haphazard system there will be a tendency for the rubber-yielding capacity of the tree to diminish, but that by careful seed selection, it should be possible to raise the rubber-yielding capacity considerably above the present average level.

Mr. Morgan also refers to trees with a smooth bark of a pink shade which are said to yield better than trees with ordinary bark. These trees are found growing in patches.

(3) The collection of seeds from particular trees. Mr. Marsden considers that this might be done by putting bird netting over the capsules on one or two branches. Owing, however, to the prevalence of pod disease (due to *Phytophthora Faberi*, see later) in Ceylon, it has been impossible to collect really healthy seeds during the last few years. This disease could be kept in check by continuous spraying over a small area intended for seed collection.

With further reference to the question of seed selection Mr. Reeve has written the following report on the two points raised, i.e.—

(4) To avoid cross-fertilisation.

(5) Assuming that both male and female elements be derived from good milkers, there would probably be poor milkers among the ancestry. This would produce throw-backs in accordance with Mendel's law which might necessitate selection over another generation.

(4) *To Avoid Cross-fertilisation.*—This difficulty could be overcome by taking cuttings in the first generation. A tree known as a good milker could be lopped and the cuttings planted in some out-of-the-way place away from other rubber trees preferably with a belt of jungle around. From these cuttings seeds would have to be saved and planted. Allowing 5-6 years in Ceylon for the trees to come into bearing, the good milkers could be picked from the bad and all the poor ones cut out. It would be necessary then to obtain seeds from the best milkers and plant separate plots from each tree's seed. When these plots come into bearing that with the least number of poor milkers could be taken as the purest strain, and from this plot after cutting out

poor milkers the seed could be saved, knowing that such seed will give on an average 50 to 60 per cent. perhaps more of good milkers. New areas would need to be planted fairly thickly, and all poor milkers could then be cut out leaving, say, 100 trees per acre known to be good milkers.

Re the point raised as to Mendelism. Is it definitely known that the property of yielding an excessive quantity of latex is capable of inheritance as a Mendelian character? If this were so the establishment of a pure race of good milkers would be comparatively simple. Consider the simplest case of Mendelian inheritance, i.e., a cross between a pure bred good milker and a pure bred bad one. The first generation would be good or poor milkers according to the dominance of the latex-giving characteristic, i.e., if the good milker were dominant, a hybrid of fairly good milkers would result. From the impure hybrids on fertilisation pure strains and hybrids would result, and it would be necessary to pick out the pure strains and breed from them.

Probably nothing so simple would occur, and as Dr. Stevens suggests, there would almost certainly be a certain amount of bad milking strain in the ancestry which would have to be eliminated by breeding.

Even if the good milking characteristic did not follow Mendel's law it would probably be an inheritable fluctuation which by selection could be improved.

Rubber trees might also have been selected from a known good milker giving, say, 8 lbs. dry rubber per annum at 12 years old with the average yield per tree at 6 lbs. per annum and a breed of rubber trees could have been obtained giving on an average say $7\frac{1}{2}$ lbs. per tree per annum, thus increasing yields 25 per cent. Such a procedure would have been the correct one, and a fairly pure strain of good yields could have been obtained in any 20 years starting from the good yielding tree in bearing. Such experiments could have been carried on indefinitely until a pure strain of good yielders were obtained.

Such a procedure is impossible now, and all that can be done is to select seeds from good yielders; if fresh planting is to be done, plant thickly and thin out poor yielders where necessary. Taking a widely planted area, say 60 trees per acre, I think fully 75 per cent. of the seeds would be fertilised from the pollen of the seed bearer, and only about 25 per cent. cross-fertilised from other trees, since an insect once it arrives at a tree stays, and does not give itself an unnecessary amount of flying. Such an area of older trees with all bad milkers thinned out would give a fairly pure strain of good milkers.

Such a seed-bearing area would, however, need continuous spraying during the S.W. monsoon in order to keep it free from attacks of pod disease (*Phytophthora Faberi*).^{*} The ordinary rubber areas are full of this disease, and I do not think more than 1 per cent. of the seeds can be considered as good and plump and fit for planting. It is the exception in this district to pick up a really good seed when walking round an estate. Naturally,

^{*} This refers to Ceylon.

isolation in jungle would partially remedy this in that spores would be filtered by the jungle, and with about one or two sprayings the area could be kept healthy.

I think the best suggestion for getting a good strain of seed is to take a small area of rubber of known yielding quality. This should be carefully watched for 2-3 years, and in this time all bad milkers could be eliminated. This would probably leave you with about 40-50 trees per acre, and these the very best yielders. This area could be kept sprayed regardless of expense in order to keep down pod disease, and the seeds from it carefully collected. It would be better of course if it were isolated from the rest of the estate to prevent any cross-fertilisation, or it could be surrounded by a belt of some quick-growing trees, such as Albizzias, to help in preventing cross-fertilisation.

The seed from such an area would not of course be a pure strain, but this could be allowed for by planting an excess of trees per acre up to 200. It is not the truly scientific method but is the most rapid one whereby a fairly pure strain could be obtained; proper scientific methods would take about 20 years' work to obtain a really satisfactory result.

Mr. Marsden raises one or two points of a more general nature. He is of opinion that the seeds selected should be not only from trees of established good yielding capacity, but also of good bark-renewing ability. Presumably the bark-renewing ability is chiefly a question of the general health of the tree, and consequently in selecting seeds from good milkers we should avoid weakly or diseased trees. Until seeds of good milkers only are available, Mr. Marsden considers that small extensions can be made without fear of disappointment if:—

(1) The healthiest plants in the nursery be taken for planting.

(2) The plants be well planted in properly cut holes.

(3) A sufficient number of trees per acre be planted, at least 150 trees per acre, to afford plenty of trees for selection in thinning out when the trees come into bearing.

We are indebted to the Rubber Growers' Association for permission to publish these extracts from their Reports.

III.—DECADES KEWENSES

PLANTARUM NOVARUM IN HERBARIO HORTI REGII CONSERVATARUM.

DECAS XC.

891. *Aconitum funiculare*, Stapf [Ranunculaceae-Helleboreae]; inter species sectionis *Napelli* tuberibus hornotinis pluribus funicularibus insigne.

Tubera (in specimine unico viso) 5; unum annotinum, caetera hornotina, omnia cylindrica, basin versus attenuata, tota longitudine radices secundarias circiter 1 cm. distantes emittentia, 3-9 cm. longa, 2-5 mm. diametro, viva pallide fusca, fractura nivea amylacea, sapore tolerabili; cambium cylindrum centrale

tenuissimum formans. *Gemmae* tuborum breviter conicae, 3-5 mm. altae. *Caulis* erectus, 4-5 dm. altus, gracilis, pilis reversis crispo-pubescentibus vel superne tomentellus. *Folia* infrafloralia sub anthesi 2, caetera 4 ramulos unifloros (vel si mavis pedicellos) suffulgentia, sensim reducta, illa ambitu reniformia, circiter 3 cm. alta, 6 cm. lata, sinu lato, 5-pedato-partita, carnosula, utrinque sparse minute pilosula, segmentis cuneatis interioribus 3-lobatis extimis 2-lobatis, lobis late linearibus vel lineari-lanceolatis acutis; petiolus infimus 5 cm. longus, folii floralis infimi brevissimus, omnes parce minute pubescentes. *Racemus* pauciflorus; pedicelli distantes, 10-6 cm. longi, pube eadem ac caulis induti, medio 2-bracteolati, bracteolis pedicellis superioribus integris lineari-lanceolatis ad 1.5 cm. longis. *Sepala* pubescentia, decidua, summum galeiforme, galea erecta apice depressa et in rostrum breve subacutum horizontaliter producta ad 2 cm. alta superne 1 cm. lata (a latere visa) lilacina, rostro virescente; sepala lateralia oblique rotundato-obovata, vix unguiculata, 1.3-1.4 cm. diametro, cum galea contigua, superne pallida, inferne magis saturate lilacina, supra medium viridimaculata; sepala inferiora elliptica, subacuta, circiter 1 cm. longa, virescentia vel virescentia. *Nectariorum* ungues in galea recte ascendentes, apice prorsus curvati, 14-18 mm. longi, summo parce pilosuli; mitella horizontalis vel cernua, latissima, suborbicularis, dorso vix gibbosa, glandula terminali lata viridi vel violacea, labio lato integro obtusissimo recurvo albido. *Filamenta* glabra, a medio basin versus alata, pallida, supra intense coerulea. *Carpella* 5, subcontigua, patule pubescentia, apice abrupte contracta; styli 2 mm. longi.

. BHOTAN, without precise locality, *Cooper* 3586.

The affinity of this new *Aconite* lies probably with *A. Hookeri*, Stapf, with which it has much in common, as the general structure of the tubers, the facies of the leaves, the inflorescence and the shape of the nectaries, but it differs from it in the absence of the characteristic hypogaeous portion of the stem and in the remarkable rope-like tubers, which are unique in the section *Napellus*. The plant was raised at Kew from seed collected by Mr. R. E. Cooper for Bees, Limited.

892. *Polyalthia Parkinsonii*, *Hutchinson* [Anonaceae-Unoneae]; species foliis eis *P. sumatranae*, Miq., valde similibus sed floribus in ramulis annotinis dense fasciculatis, pedicellis gracilioribus, petalis brevioribus et fructibus haud costatis differt.

Arbor parva; ramuli annotini florum fasciculos densos gerentes, leviter flexuosi, 6-7 mm. crassi, cortice cinereo lenticellato rugoso obtekti, efoliati, hornotini fusco-brunnei, circiter 2.5 mm. crassi, glabri, internodiis circiter 2 cm. distantibus. *Folia* oblonga, obtuse subabrupte acuminata, basi obtusa et leviter inaequalia, 10-20 cm. longa, 3-6 cm. lata, chartacea, glabra, supra subnitida, tenuiter reticulata, infra albo-glauca; costa supra impressa, infra conspicua; nervi laterales utrinsecus 8-10, graciles, utrinque prominuli, marginem versus arcuati; petioli 0.7-1 cm. longi, nigri, minute transverse rugosi, glabri. *Flores*

in ramulis efoliatis annotinis dense fasciculati, numerosi; pedicelli subgraciles, 2 cm. longi, glabri. *Sepala* 3, triangularia, obtusa, 1.75 mm. longa, minute pubescentia, coriacea. *Petala* 6-7, oblonga vel anguste oblonga, obtusa, circiter 1.3 cm. longa, 2 mm. lata, coriacea, extra dense tomentella, intra parce tomentella. *Stamina* sessilia, brevissima, 0.75 mm. longa, connectivo truncato crasso. *Carpella* parva, glabra, stigmatibus sessilibus truncato crasso coronata. *Fructus* subglobosus, breviter stipitatus, circiter 2 cm. diametro, glaber, subnitidus.

INDIA. Andaman Islands: Long Island; Bom-ling-la, Feb., fr., *Parkinson* 943; without precise locality, Dec., fls., *Parkinson* 765, 794.

893. *Leea Venkobarrowii*, *Gamble* [Vitaceae]; species distincta, nullae aliae peraffinis, foliis lanceolatis asperis serratis, floribus albo-viridibus et lobis tubi staminiferi integris vel minute apiculatis insignis.

Frutex humilis, subherbaceus, ramulis ultimis striatis puberulis. *Folia* bipinnata, ad 40 cm. longa; foliola lanceolata vel ovato-lanceolata, apice longe acuminata, basi rotundata vel interdum, praecipue lateralia, cordata, margine serrata serraturis, 1-2 ad quemque nervum lateralem; pagina superior strigosa, aspera, inferior ad nervos et reticulationem crispato-pubescentia; nervi laterales oppositi, utrinque circiter 8-12, nervulus transversus subparallelis; petiolus communis 6-14 cm. longus. *Flores* albo-virides, in cymas corymbosas in foliorum supremorum axillis per paria dispositi; corymbi 6-12 cm. longi, aperti, ad 5 mm. lati. *Calyx* campanulatus, puberulus, lobis ovatis tubo aequilongis 1 mm. longis. *Petala* ovato-oblonga, reflexa, apice cucullata. *Tubus stamineus* lobis 5 oblongis apice integris vel minute apiculatis; antherae introrsum spectantes, ad margines connatae. *Ovarium* ovatum, glabrum, stylo brevi, stigmatibus capitato. *Fructus* non visus, sed niger dictus.

SOUTH INDIA. Anamalai Hills, Coimbatore district, 940 m., *J. S. Gamble* 14646. Hills of Travancore, in evergreen forests, up to 1310 m., *Venkoba Row*.

Dried specimens, as pointed out some years ago on an examination of my specimen, by Sir George King, resemble those of *L. setuligera*, C. B. Clarke, but the flowers are greenish and not red, and the lobes of the staminal tube are quite different. Mr. Venkoba Row calls it a "tree rising to 30 ft.," but probably he was thinking of his gatherings of *Leea sambucina*, a totally different species. This is probably an undershrub like *L. crispa*.

894. *Ellipanthus neglectus*, *Gamble* [Connaraceae]; *E. monophyllo*, Benth. et Hook. f., affinis, floribus majoribus et foliorum nervatione distincta, nervis lateralibus conspicue arcuatim junctis differt.

Arbor parva, ramulis teretibus ultimis molliter ferrugineo-puberulis. *Folia* unifoliolata, coriacea, elliptica, apice subito cuspidato-acuminata, basi cuneata, 8-12 cm. longa, 3-5.5 cm.

lata, supra praeter costam glabra, nitida, reticulata, infra ad costam et nervos pubescentia; nervi laterales utrinque 7-8, curvati, conspicue arcuatum juncti et marginem versus arcubus multis minoribus muniti, reticulatione conspicua; petiolus 1-1.5 cm. longus, pubescens. *Flores* in racemos axillares ferrugineo-tomentosos fasciculatos 1-1.5 cm. longos dispositi. *Calycis lobis* ovati, acuti, 1.5 mm. longi. *Petala* oblonga, extus villosa, intus glabra, 5 mm. longa. *Stamina* alternatim longa et breviora, omnia filamentis subulatis dense ferrugineo-sericeis. *Ovarium* strigosum-villosum. *Folliculi* ovati, dense ferrugineo-velutini, 2-2.5 cm. longi, stipite 6-7 mm. longo, sepalis et filamentis generaliter persistentibus. *Semen* oblongum, apice ex folliculo exsertum, basi arillo brevi roseo circumdatum; testa nigro-coerulea, nitida; cotyledones plano-convexi. *E. monophyllus* var. *neglectus*, O. Kze. MSS. in Herb. Kew. *E. Thwaitesii*, Brandis, Ind. Trees, 212; Bourdillon, Travancore Trees 128, non Hook. f.

SOUTH INDIA. Hills of Tinnevely, *Beddome*; Travancore, in evergreen forests at low levels, *Bourdillon*; *Venkoba Row*.

895. ***Crotalaria Bidiei***, Gamble [Leguminosae-Genisteae]; *C. alatae*, Ham., affinis, foliis dimorphis, alis stipularibus longe auriculatis, floribus et legumine majoribus differt.

Suffrutes erectus, ferrugineo-pubescent. *Folia* dimorpha, brevissime petiolata, inferiora ovata, apice acuta, mucronata, basi attenuata, 4-7 cm. longa, 2-4 cm. lata, infra subglauca, superiora in ramulis ultimis anguste lineari-oblonga, griseo-fulvo-pubescentia, ad 4 cm. longa, 5 mm. lata; alae stipulares 1-2 mm. latae, superne auriculis longis acuminatis erectis vel paullo recurvis munitae. *Racemi* axillares, pauciflori, 5-9 cm. longi, longe pedunculati; flores 10-15 mm. longi; bracteae et bracteolae ovatae, acuminatae. *Calyx* paullo bilabiatus, 1.5 cm. longus, lobis longe acuminatis corolla longioribus. *Corolla* flava; vexillum orbiculatum, basi auriculis duabus munitum; alae oblongae, in unguem brevem abrupte angustatae; carinae petala rostrata dorso juncta basi ungue brevi instructa, marginibus ciliatis. *Ovarium* glabrum. *Legumen* cylindricum, glabrum, maxime inflatum, breviter (5 mm.) stipitatum, 4 cm. longum, 1-1.5 cm. latum, seminibus plurimis.

SOUTH INDIA. Nilgiri hills, 1873, Dr. G. Bidie; *Beddome*; Neddikarna to Nedimballi, South Wynaad, Jan. 1903, C. A. Barber 5627.

896. ***Crotalaria Clarkei***, Gamble [Leguminosae-Genisteae]; *C. triquetrae*, Dalz., affinis, robustior, ramulis quadrangulis raro triquetris, floribus majoribus et legumine patule villosa 3 cm. longo differt.

Suffrutes erectus, gracilis, ramis quadrangulis, ramulis aliquando triquetris strigoso-hirsutis. *Folia* brevissime petiolata, chartacea, ovato-oblonga, apice obtusa vel acutiuscula, basi obtusa vel subcordata, 2-4.5 cm. longa, 0.75 to 1.5 cm. lata,

marginibus reflexis, utrinque pilis basi bulbosis strigoso-hirsuta; nervi utrinque circa 8, paria 2 infima basi orta; stipulae lanceolatae, 3-4 mm. longae, reflexae. *Racemi* terminales, 12-18 cm. longi, 3-8-flori, floribus distantibus sed prope apicem numerosioribus; bractae parvae, ovatae, acutae; bracteolae lineares, minimae. *Calyx* ad 1 cm. longus, lobis patentibus lanceolatis ferrugineo-villosis. *Corolla* calyce longior, flava; vexillum obovatum, dorso sericeo-villosum, ad 15 mm. longum; alae oblongae, paullo breviores, basi unguiculatae; carinae petala rostrata, dorso parce villosa, marginibus ciliatis. *Ovarium* oblongum, dense sericeo-villosum. *Legumen* oblongo-cylindricum, pilis sericeis patentibus dense vestitum, 3 cm. longum, seminibus circa 15-25.

SOUTH INDIA. Nilgiri Hills at Naduvattam, 1800 m., *C. B. Clarke* 1136; *M. A. Lawson*; Devala, 920 m., *Gamble* 15622; Anaimalai Hills, *Beddome*; Pulney Hills, Silver Cascade Ridge, etc.. *Bourne* 1072; *Beddome*; *Saulière*; South Tinnevely, *Beddome*; Courtallum, *Wight*.

897. *Crotalaria scabra*, *Gamble* [Leguminosae-Genisteae]; *C. barbatae*, *Grah.*, affinis, floribus minoribus et foliis ellipticis duris circiter 3 cm. solum longis 1.5 cm. latis marginibus conspicue reflexis scabro-hirsutis nec sericeo-villosis differt.

Frutex (?) erectus, ramulis scabris pilis basi bulbosis strigosis, ultimis ferrugineo-pubescentibus. *Folia* dura, elliptica, apice obtusa vel raro subacuta, basi rotundata, 2-3.5 cm. longa, 1-1.5 cm. lata, marginibus reflexis, supra parce infra densius pilis hirsutis basi bulbosis munita; petiolus perbrevis aut nullus; stipulae 0. *Flores* in racemos terminales 6-10 cm. longos dense ferrugineo-villosos dispositi; bractae lineares, 5-7 mm. longae; bracteolae e tubo calycino ortae, lanceolatae, 5 mm. longae. *Calyx* bilabiatus, dentibus 2 superioribus lanceolatis 12 mm. longis, 3 inferioribus linearibus paullo longioribus intra glabris extra pilis rigidis dense sericeo-villosis. *Corolla* flava (?); vexillum orbiculatum, 1.5 cm. diametro, basi glandulis 2 pubescentibus munitum; alae oblongae, vexillo aequales, basi unguiculatae; carinae petala rostrata, unguiculata, marginibus pubescentibus. *Ovarium* glabrum, apice curvatum. *Legumen* cylindricum, glabrum, inflatum, breviter stipitatum, 3 cm. longum, 1-1.5 cm. latum.

SOUTH INDIA. Tinnevely District. on Agasthyamalai Peak, 1920 m., May, 1901, *C. A. Barber* 2931.

898. *Crotalaria shevaroyensis*, *Gamble* [Leguminosae-Genisteae]; species *C. longipedi*, *Wight & Arn.*, et *C. subperfoliatae*, *Wight*, affinis, ab hac pedicellis alternis et leguminibus fere glabris, ab illa bracteolis a calyce distantibus et bracteis reflexis persistentibus supra nitidis viscosis differt.

Suffrutex erectus, ferrugineo-villosus, paniculatim ramosus. *Folia* obovato-oblonga, subsessilia, apice cuspidato-acuta, basi attenuata, 4-8 cm. longa. 2-3 cm. lata, utrinque sericeo-villosa, nervis utrinque circa 7 infra conspicuis; stipulae parvae, lineares,

vel 0. *Paniculae* pyramidatae, ramis multiracemosis, bracteis multis persistentibus alternis vel oppositis reflexis nigris ornatis. *Racemi* circiter 3-5-flori, 6-8 cm. longi; bracteae ovato-acuminatae, 1 cm. longae, supra glabrae, nitidae; bracteolae a calyce circa 7 cm. distantes, ovato-acuminatae, 6-7 mm. longae. *Calyx* circiter 1.7 cm. longus, lobis margine revolutis, 2 superioribus lanceolatis, 3 inferioribus linearibus. *Corolla* flava, exserta; vexillum suborbiculare, apice acutum, dorso sericeo-villosum, fere 2 cm. diametro; alae oblongae, vexillo paullo breviores, basi conspicue unguiculatae; carinae petala rostrata, glabra sed margine ciliata. *Legumen* oblongum, glabrum vel minutissime puberulum, apice attenuatum, basi in pedicellum conspicuum 1 cm. longum attenuatum, 3.5-4 cm. longum, seminibus circa 16.

SOUTH INDIA. Yercaud. Shevaroy Hills, Salem district, about 1600 m., Dr. G. Bidie; Bourne 2197; Madura district, Beddome.

399. *Crotalaria sandoorensis*, Beddome MSS. in Herb. Kew. [Leguminosae-Genisteae]; *C. lunulatae*, Heyne, et *C. paniculatae*, Willd., affinis, ab hac bracteis et bracteolis non linearibus; ab illa bracteis et bracteolis non lunulatis, ab ambabus stipulis minutis subulatis vel 0 nec conspicuis, etiam legumine exserto, seminibus 5-7 differt.

Suffrutex erectus, molliter ferrugineo-villosus, paniculatus ramosus. *Folia* subsessilia, lanceolata, mucronata, 4-5 cm. longa, 1-1.25 cm. lata, utrinque pilis longis mollibus sericeis villosa. nervis utrinque circa 6-7 inconspicuis; stipulae minutae, subulatae vel 0. *Paniculae* pyramidatae, ramosae, ramis 1-3-floris, bracteis multis ovato-acuminatis reflexis supra nitidis viscosis siccitate nigris; bracteae sub pedicello 7 mm. longae, subcoardatae, longe acuminatae, supra glabrae; bracteolae binae similes e medio pedicello ortae, a calyce 4 mm. distantes. *Calyx* 1.25 cm. longus, lobis longe acuminatis margine reflexis; lobi 2 superiores lanceolatae, 3 inferiores angustiores. *Corolla* calyce duplo longior; vexillum obovatum, dorso sericeum, 1.5 cm. diametro; alae angustae, oblongae, 1.75 cm. longae; carinae petala rostrata, glabra, margine ciliato excepta. *Legumen* oblongum, obtusum, pilis longis villosum, 2 cm. longum, seminibus magnis 5-7.

SOUTH INDIA. Sandoor Hills, Bellary district, May, 1880, Col. R. H. Beddome.

900. *Chrysopogon setifolius*, Stapf [Gramineae-Andropogoneae]; affinis *C. pallido*, Stapf (*Andropogon pallido*, Kunth), sed foliorum laminis subsetaceis canaliculatis, panícula contracta angustissima, spiculis muticis, callo brevi breviter barbato distinctus.

Gramen sine dubio pereune, circiter 4 dm. altum. *Culmi* pergraciles, erecti, simplices, 3-nodi, internodio summo solo exserto. *Foliorum* vaginae basales exteriores haud visae, caeterae teretes, nervoso-striatae, infima in dorso, imprimis

margines versus, et ad os pilosa, superiores glabrae, laeves, summa lamina destituta; ligulae ad marginem ciliolatum redactae; laminae subsetaceae, lateraliter leviter compressae, canaliculatae, ad 20 cm. longae, ad 0.75 mm. latae, ligulam versus pilosae, praeter apicem scaberulum laeves, nervoso-striatae. *Panicula* angustissima, contracta, ad 9 cm. longa; rhachis gracilis uti rami glabri laevesque, hinc ad nodos solitarii vel interdum 3-4-tim verticillati, tenuiter filiformes, 5-20 cm. longi, erecti, apice paulo incrassato albido-ciliato; pedicelli filiformes, glabri, ad 4.5 mm. longi. *Spicula sessilis* lineari-lanceolata, acuminata, pallida, glabra, 8 mm. longa; callus perbrevis, obtusus, barbatus, pilis antice ad 2 mm. longis. *Glumae* aequales; inferior margines versus a medio sursum aculeolata, dorso praeter apicem asperum laevis, nervis tenuissimis intracarinalibus 5, extracarinalibus utrinque 2; superior in carina superne aspera, nervis 6-7, margine ciliata. *Valva* anthocicii inferioris 6-7 mm. longa, tota hyalina, 2-nervis, reverse ciliata, superioris explanata elliptico-lanceolata, acuta, 4.5 mm. longa, mutica, in dorso anguste chartacea, caeterum hyalina, ultra medium tenuissime 3-nervis, abhinc 1-nervis. *Valvula* phyllis 2 a basi liberis lineari-oblongis ciliatis, 2.5 mm. longis 1-nervibus substituta. *Lodiculae* carnosae, late cuneatae. *Stamina*? *Stigmata* plumosa, paulo supro basin lateraliter exserta. *Spiculae pedicellatae* ♂, pallidae, anguste lanceolatae, acutae, 8 mm. longae. *Glumae* aequales, glabrae, inferior circiter 9-nervis, superior 3-5-nervis. *Valva* inferior 6 mm., superior 5 mm. longa, hacce tota hyalina, 3-nervis. *Antherae* 2.5 mm. longae.

NORTH AUSTRALIA. Port Darwin, *Schultz* 661.

The replacement of the valvule by two 1-nerved phylla is very unusual and suggests some anomaly in the development of the spikelets. These appear, however, perfectly healthy in every respect, and are of the usual gryllus-type, except for the absence of an awn in the upper floret whose value is, moreover, chartaceous over a narrow portion of the back. But even if these peculiarities of the sessile spikelets should prove to be anomalous, the structure of the leaf-blade alone would suffice to distinguish this species from all the other species which are immediately allied to *Chrysopogon Gryllus*, Trin.

IV.—THE BOTANIC STATION, KADUNA.

In the Annual Report of the Agricultural Department, Northern Provinces, Nigeria, for 1914 reference was made to the establishment of the new capital at Kaduna and the planting of the place with economic and ornamental trees. It was announced that a strip half a mile long had been chosen along the river bank near the new site, nurseries made and a large number of seedling trees grown. Choice Citrus and Mango trees had also been introduced from Dominica and Trinidad and been propagated successfully by grafting and budding.

In the Annual Report of the Department for 1915, recently received, the Director of Agriculture gives the following particulars about the new station:—

“The approximate latitude of this station is 10 degrees north, its height above sea level is roughly 2000 feet, and its average rainfall about 50 inches.

‘The rainfall for 1915 amounted to 61·82 inches, and was confined to the period from March 17th to October 12th, inclusive.

“The site on the bank of the Kaduna River, which was selected early in 1914 for a nursery garden, has proved most suitable. The area, comprising some 7 acres, and extending in a narrow strip close to the water for nearly half a mile, has now been enclosed by a wire fence. A tool-house, potting-shed, and concrete ant-proof trough, for striking cuttings, have also been added.

“A large number of trees and shrubs—both economic and ornamental—have been raised and planted in the new capital.

“Avenues have been established along $3\frac{1}{2}$ miles of road, and the boundaries of most of the compounds on either side have been permanently defined by means of hedges. All but the narrowest roads have been planted with a double avenue, involving therefore 4 rows of trees. The trees have been planted 20 feet apart in the row, so the number of trees required per mile has been approximately 1000.

“The principal trees employed have been *Albizzia Lebbek*, *Albizzia moluccana*, *Poinciana regia*, *Mangifera indica*, *Khaya senegalensis*, *Eriodendron anfractuosum*, *Tamarindus indica*, *Eucalyptus* spp., *Gliricidia maculata* and *Adenanthera pavonina*.

“The species most generally used for hedges are *Caesalpinia pulcherrima*, *Thevetia nerifolia*, *Melia Azedarach*, and the common lime.

“An area of some 22 acres intended for public gardens was cleared and stumped by hand. The ground was then prepared by means of Planet-Junior cultivators drawn by cattle.

“It has since been laid down with Doob grass (*Cynodon Dactylon*) partly from seed and partly with runners obtained from a plot established at Maigana in 1913.

“The result is very gratifying, a fair turf having been obtained in less than a year.”

V.—MISCELLANEOUS NOTES.

DANIEL OLIVER.—The death, on 21st December, 1916, of Professor Daniel Oliver, F.R.S., LL.D., who for over a generation took a prominent part in the activities of the Royal Botanic Gardens, the reputation of which his eminent labours have done so much to enhance, has been felt as a personal loss by former and present members of the Kew staff. The deceased, who was in his eighty-seventh year, was the son of Daniel Oliver, Newcastle-on-Tyne, where he was born on 6th February, 1830. His early education was received partly in private schools, partly at the

Friends' School, Brookfield, near Wigton. His devotion to botanical study began at an early age, his first contribution to the subject being published when he was 17. Already an active member of the Tyneside Naturalists' Field Club, he became in 1851 a member of the Edinburgh Botanical Society, and in 1853 a fellow of the Linnean Society. His reputation in 1858 was already so thoroughly established as to lead to an invitation from Sir W. J. Hooker, then Director of Kew, to become an assistant in the Herbarium. A year later Oliver inaugurated a course of lectures on botany for the benefit of the young gardeners employed at Kew, which he conducted without a break until 1874. In 1861 Oliver was appointed professor of botany at University College, a position which he occupied till 1888. In 1863 he was elected a fellow of the Royal Society, and in 1864, on the retirement through ill-health of the late Mr. A. Black, he was appointed keeper of the Herbarium and Library at Kew, a post which he held until 31st May, 1890. His active participation in the work of the establishment continued, however, for five more years, as editor on behalf of the Bentham Trustees of Hooker's *Icones Plantarum*. He took, in addition, an active interest in the work of the Linnean Society, on whose council he served from 1861 to 1863, and again from 1872 to 1874. He also served on the council of the Royal Society in 1875-76, and again from 1880 to 1882. In the latter year the Edinburgh Botanical Society, of which he had long been a member, elected him one of their six British honorary fellows, and in 1884, on the motion of the council of the Royal Society, he was the recipient of a Royal Medal.

When Oliver retired from the public service in 1890 the First Commissioner of Works placed on record the high appreciation of Her Majesty's Government of the valuable services rendered by him to the Royal Botanic Gardens and the distinguished ability which he had brought to bear on the work of his department. In the following year the University of Aberdeen conferred upon him the honorary degree of LL.D., and in 1893 the Linnean Society awarded him its gold medal; the President, in handing him this award, summarised in the happiest terms his varied activities and his eminent services to botanical science (*K.B.* 1893, p. 188). Later in 1893 a portrait of Oliver by Mr. J. Wilson Forster was presented by a number of his friends to the Herbarium at Kew (*K.B.* 1894, p. 78).

A list of his contributions to botanical literature is given below.

LIST OF PUBLICATIONS BY THE LATE PROFESSOR D. OLIVER.

List of a few Plants found in Bouldersdale and Teesdale, together with the formations on which they were found. (*Phytologist*, ii. 1847, p. 986.)

Botanical notes of a week in Ireland during the present month, August, 1852. (*Phytologist*, iv. 1852, pp. 676-679.)

On certain structures observed in *Pentas carnea*, Benth. (*Gard. Chron.*, 1852, p. 822.)

Note on *Pyrola rotundifolia*, var. *arenaria*. (*Phytologist*, iv. 1853, pp. 1119-1120.)

Abstract, &c., of a paper entitled "Observations on the growth in diameter of Dicotyledonous (Exogenous) Stems." (Trans. Tyneside Nat. Field Club, iii. 1854-58, pp. 64-68, t. 2.)

Memoranda of Plants collected by the *Coquet* in 1855. (Trans. Tyneside Nat. Field Club, iii. 1854-58, pp. 68-72.)

Note respecting certain glandular appendages of the Leaves in the autumn rosettes of *Epilobium montanum*. (Journ. Linn. Soc., i. 1857, pp. 190-191.)

Notes on Plants new to the Flora of Northumberland, with observations on some critical species. (Trans. Tyneside Nat. Field Club, iv. 1858-60, pp. 44-50.)

Note upon the occurrence of a Rotiferon in *Vaucheria*. (Trans. Tyneside Nat. Field Club, iv. 1858-60, pp. 263-265.)

The Indian species of *Utricularia*. (Journ. Linn. Soc., iii. 1859, pp. 170-190, t. 1.)

Observations on the structure of the Stem in certain species of the natural orders *Caryophylleae* and *Plumbagineae*. (Trans. Linn. Soc., xxii. 1859, pp. 289-294, tt. 50-51.)

Descriptions of new species of *Utricularia* from South America, with notes upon the genera *Polypompholyx* and *Akenra*. (Journ. Linn. Soc., iv. 1860, pp. 169-176.)

Notes upon the British Herbarium of the Linnean Society. (Journ. Linn. Soc., iv. 1860, pp. 194-198.)

Botanical Bibliography. Phanerogamia. 1860. (Nat. Hist. Review, i. 1861, pp. 360-398).—1861. (l.c. ii. 1862, pp. 416-485).—1862. (l.c. iii. 1863, pp. 574-625).

The Natural History Review, edited by G. Busk . . . [and others, including D. Oliver.] [New Series.] Vols. i.-v. London, 1861-65. 8vo.

The natural order *Aurantiaceae*, with a synopsis of the Indian species. (Journ. Linn. Soc., v. 1861, Suppl. 2, pp. 1-44.)

Official Guide to the Kew Museums. A Handbook to the Museums of Economic Botany of the Royal Gardens, Kew. [London], 1861. 8vo. pp. 82.—[Another ed.] Ib., 1862.—Ed. 2. Ib., 1863.—Ed. 3. Ib., 1866, pp. 86.—Ed. 4. Ib., 1868.—Ed. 5. Ib., 1871, pp. 87.—Ed. 6. Ib., 1875, pp. 92. [Eds. 3-6 with additions and corrections by J. R. Jackson.]

On *Sycopsis*. (Trans. Linn. Soc., xxiii. 1862, pp. 83-89, t. 8.)

Note on the structure of the Anther. (Trans. Linn. Soc., xxiii. 1862, pp. 423-428, t. 44.)

Note on *Hamamelis* and *Loropetalum*; with a description of a new *Anisophyllea* from Malacca. (Trans. Linn. Soc., xxiii. 1862, pp. 457-461, t. 48.)

The Atlantis Hypothesis in its botanical aspect. (Nat. Hist. Review, ii. 1862, pp. 149-170.)

The structure of the Stem in Dicotyledons. (Nat. Hist. Review, ii. 1862, pp. 298-329; iii. 1863, pp. 251-258.)

On the distribution of Northern Plants. (Proc. Roy. Inst., iii. 1862, pp. 431-433; Geologist, v. 1863, pp. 262-263.)

On some new species of *Amomum* from West Africa, by D. Oliver and D. Hanbury. (Journ. Linn. Soc., vii. 1863, pp. 109-110.)

Notes on the *Loranthaceae*, with a synopsis of the genera. (Journ. Linn. Soc., vii. 1863, pp. 90-106.)

Guide to the Royal Botanic Gardens and Pleasure Grounds, Kew. Ed. 22. London, 1863. 8vo. pp. 56 and 3 plans.—Ed. 23. Ib., 1865, pp. 59 and 3 plans.—Ed. 24. Ib., 1867, pp. 63 and 3 plans.—Ed. 25. Ib., 1870, pp. 110, text-figs. 56 and 7 plans.—Ed. 26. Ib., 1872, pp. 112, text-figs. 56 and 7 plans.—Ed. 27. Ib., 1875.—Ed. 28. Ib., 1878, pp. 118, text-figs. 54 and 8 plans.—Ed. 29. Ib., 1881.—Ed. 30 ["29"]. Ib., 1885, pp. 184, text-figs. 54 and 8 plans.

Note on the structure and mode of dehiscence of the Legumes of *Pentaclethra macrophylla*, Benth. (Trans. Linn. Soc., xxiv. 1864, pp. 415-420, t. 37.)

Lessons in Elementary Botany. The part on Systematic Botany based upon material left in manuscript by the late Professor Henslow. London & Cambridge, 1864. 8vo. pp. viii. 317, text-figs. 183. [Ed. 2 was published in 1869, and Ed. 3 in 1878. Both editions were reprinted several times, the last impression appearing in 1910.]

On four new genera [*Piptostigma*, *Rhaptopetalum*, *Leptocladus*, *Octolepis*] of Plants of Western Tropical Africa; and on a new species of *Paropsia* (*P. guineensis*). (Journ. Linn. Soc., viii. 1865, pp. 158-162, t. 12.)

Loranthaceae Mexicanæ et Centro-Americanae. Enumeratio specierum hujus familiae, quas in regno Mexicano Liebmann et in America Centrali Örsted legerunt. (Vidensk. Meddel., Kjöbenhavn, vi. 1865, pp. 170-177.)

On *Hillebrandia*, a new genus of *Begoniaceae*. (Trans. Linn. Soc., xxv. 1866, pp. 361-364, t. 46.)

On the *Lentibulariaceae* collected in Angola by Dr. Welwitsch, with an enumeration of the African species. (Journ. Linn. Soc., ix. 1867, pp. 144-156.)

Notes upon a few of the Plants collected, chiefly near Nagasaki, Japan, and in the islands of the Korean Archipelago, in the years 1862-63, by Mr. Richard Oldham. (Journ. Linn. Soc., ix. 1867, pp. 163-170.)

On five new genera of West Tropical Africa [*Dasylepis*, *Pyramidocarpus*, *Ancistrocarpus*, *Enantia*, *Cleistochlamys*], with a note upon the genera *Oncoba* and *Mayna*. (Journ. Linn. Soc., ix. 1867, pp. 170-176.)

Note to Dr. T. Anderson's paper on two species of *Guttiferae*. (Journ. Linn. Soc., ix. 1867, pp. 261-263.)

Memorandum on the genus *Thamnea*, Solander, and other *Bruniaceae* contained in the South African Herbarium of the late Dr. Burchell. (Journ. Linn. Soc., ix. 1867, pp. 331-333.)

Phanerogamia and Vascular Cryptogamia of Greenland, 68°-70° N.L. (Trans. Edinburgh Bot. Soc., ix. 1868, pp. 447-452.)

Phanerogamia and Vascular Cryptogamia [of Disco Bay, Greenland]. (In *Florula Discoana*, by R. Brown; Trans. Bot. Soc. Edinb., ix. 1868, pp. 447-452. Reprinted in *Manual of the Natural History . . . of Greenland*, 1875.)

Flora of Tropical Africa, by D. Oliver, assisted by other

Botanists. Vols. i.-iii. London, 1868-1877. 8vo. [D. Oliver elaborated the following orders:—Vol. i. (pp. 14+xli.+179): *Ranunculaceae* to *Dipterocarpeae*, *Lineae* to *Geraniaceae* (*Impatiens* by Sir J. D. Hooker), *Rutaceae* to *Celastraceae* and *Anacardiaceae*. Vol. ii. (pp. viii.+613): *Leguminosae* (suborders *Caesalpinieae* and *Mimoseae*), *Saxifragaceae*, *Droseraceae* to *Rhizophoraceae*, *Onagrarieae*, *Cactaceae*, and *Ficoideae*. Vol. iii. (pp. viii.+544): *Compositae* (with W. P. Hiern), *Ericaceae*, *Plumbagineae*, and *Primulaceae*.]

First Book in Indian Botany. London, 1869. 8vo, pp. xi.+393, text-figs. 242. [The last impression, the 9th, was published in 1911.]

Description of three new genera [*Allanblackia*, *Alsodeiopsis*, *Campylostemon*] from West Tropical Africa, belonging to the Natural Orders *Guttiferae*, *Olcaceae*, and *Celastraceae*. (Journ. Linn. Soc., x. 1869, pp. 42-44.)

Notes of ten lectures on "Botany" delivered . . . in the . . . South Kensington Museum during March and April, 1870. [London, 1870.] 8vo, pp. 24.

The Botany of the Speke and Grant Expedition; an Enumeration of the Plants collected during the journey of the late Capt. J. H. Speke and Capt. (now Lieut.-Col.) J. A. Grant, from Zanzibar to Egypt, the determinations and descriptions by D. Oliver and others . . . with an introductory preface by Colonel Grant. (Trans. Linn. Soc., xxix. 1872-75, pp. 1-190, tt. 1-136 and Map.)

On *Begoniella*, a new genus of *Begoniaceae* from New Granada. (Trans. Linn. Soc., xxviii. 1873, pp. 513-514, t. 41.)

Descriptions of three new genera of Plants in the Malayan Herbarium of the late Dr. A. C. Maingay: [*Pteleocarpa*, *Ctenolophon*, *Maingaya*]. (Trans. Linn. Soc., xxviii. 1873, pp. 515-518, tt. 42-44.)

Illustrations of the principal Natural Orders of the Vegetable Kingdom. The plates by W. H. Fitch. London, 1874, obl. 4to. pp. 154, col. tt. 109.

List of Plants collected by H. N. Moseley on Kerguelen's Land, Marion Island, and Yong Island. (Journ. Linn. Soc., xiv. 1875, pp. 389-390.)

Note on *Lyallia kerguelensis*, Hk. f. (Journ. Linn. Soc., xiv. pp. 389-390.)

Note on a Fruit from Comassi, collected by Lieut. de Hoghton and sent to Kew by Major Bulger. (Journ. Linn. Soc., xiv. 1875, pp. 457-458.)

[List of Flowering Plants from Ellesmere Land and Grinnell Land.] (Sir G. S. Nares, Narrative of a Voyage to the Polar Sea during 1875-6. Vol. ii. 1878, pp. 302-312.)

List of Plants collected in New Guinea by Dr. A. B. Meyer, sent to Kew, December, 1874. (Journ. Linn. Soc., xv. 1875, pp. 29-30.)

Enumeration of Plants collected by V. Lovett Cameron, Lieut. R.N., in the region about Lake Tanganyika. (Journ. Linn. Soc., xv. 1876, pp. 90-97.)

Note on a collection of North Celebes Plants made by Mr.

Riedel, of Gorontalo. (Journ. Linn. Soc., xv. 1876, pp. 97-100.)

Remarks [on Dr. Kirk's paper: Note on specimens of *Hibiscus* allied to *H. rosa-sinensis*, L., collected in E. Tropical Africa 1875.] (Journ. Linn. Soc., xv. 1876, pp. 479-480, figs. 1-2.)

Enumeration of Plants collected in the region about Lake Tanganyika. (V. L. Cameron, Across Africa. Vol. ii. 1877, App. I.)

Copy of Professor Oliver's determination of Plants collected near Akaba . . . 1874. (E. Beke, The late Dr. Charles Beke's discoveries of Sinai in Arabia and of Midian, 1878, pp. 593-594.)

[Flowering Plants of the Arctic Regions.] (Sir A. H. Markham, A Polar Reconnaissance, 1881, App. A.)

[Botany of Matabele Land.] (F. Oates, Matabele Land, 1882, pp. 366-369, tt. J K.)

List of Plants collected by Mr. Thomson, F.R.G.S., on the Mountains of Eastern Equatorial Africa, by D. Oliver; with observations on their distribution by Sir J. D. Hooker. (Journ. Linn. Soc., xxi. 1885, pp. 392-406.)

Enumeration of the Plants collected . . . on the Kilima-njaro Expedition, 1884, by D. Oliver and J. G. Baker. (H. H. Johnston, The Kilima-njaro Expedition, 1886, pp. 337-349.)

List of Plants collected in the Islands of Bougainville Straits, Solomon Group, during 1884, by H. B. Guppy, [the determinations chiefly by D. Oliver.] (H. B. Guppy, The Solomon Islands and their Natives, 1887, pp. 294-304.)

The Botany of the Roraima Expedition of 1884; being notes on the Plants observed by Everard F. im Thurn, with a list of the species collected, and determinations of those that are new, by D. Oliver and others. (Trans. Linn. Soc., ser. 2, ii. 1887, pp. 249-300, tt. 37-46.)

Flora of Somali-Land. Plants collected . . . by Messrs. James and Thrupp. (F. L. James, The Unknown Horn of Africa, 1888, pp. 318-323, tt. 1-4.)

Hooker's Icones Plantarum. Third Series, vol. x. pt. 2 to Fourth Series, vol. v. pt. 1 (tt. 1926-2425), edited by D. Oliver. London, 1890-95. 8vo. [Besides editing the work he was the author of most of the text during this period. He also contributed frequently to previous volumes, dating back to the beginning of the Third Series in 1867, and supplied the text to 34 of the plates (2426-2486) issued after he ceased to be editor.]

CHARLES CROSSLAND.—The news of the death of Mr. Charles Crossland, of Halifax, on December 9 will be received by British mycologists with great regret. Of a gentle and retiring disposition, Mr. Crossland was unknown personally to many, but in the north of England, and especially in his native county, his enthusiasm for all branches of field botany and especially mycology, coupled with his charm of manner, made him a leader beloved and respected.

Mr. Crossland was born at Halifax in 1844. He left school early, and, after being duly apprenticed, he became a butcher, in which trade he continued till comparatively recently. He was

early interested in botany and natural history, but it was not until 1888 that, at the suggestion of Mr. G. Masee, he took up fungi as a special study. Mr. Crossland's enthusiasm in collecting, his care in preserving and drawing his finds, gave him as years went on a thorough knowledge of the plants. He became an authority on the group of Discomycetes, and published many notes on these and other critical British fungi. For many years he was Secretary of the Mycological Committee of the Yorkshire Naturalists' Union, an enthusiastic band which has rendered Yorkshire mycologically famous. In 1902, in conjunction with Mr. Masee, he published a "Fungus Flora of Yorkshire," and two years later the "Flora of Halifax," in collaboration with W. B. Crump. Mr. Crossland was one of the founders of the British Mycological Society, a Fellow of the Linnean Society, and in 1907 he was President of the Yorkshire Naturalists' Union. His collections of dried fungi together with his beautiful series of coloured drawings were purchased by Kew in 1914 (see *Kew Bulletin*, 1914, p. 173). A sketch of Mr. Crossland's life and a list of his published works appeared in *The Naturalist*, 1910, pp. 367-374.

A. D. C.

Additions to Gardens.—Owing to difficulties caused by the war there was a great falling off in the exchange of plants, seeds, etc., between Kew and other establishments. The principal receipts were:—

Botanic Gardens and other institutions:

Arnold Arboretum—Hardy trees and shrubs.

Washington, Department of Agriculture—Various plants and seeds.

Loanda, Angola—Seeds of Palms, etc.

Egypt, Ministry of Agriculture—Seeds of *Hyoscyamus muticus* and of tropical trees and shrubs.

Kirstenbosch, Cape Colony—Seeds of Cycads and Narras (*Acanthosicyos horrida*).

Uganda, Forestry Department — Seeds of *Choananthus Cyrtanthiflorus* from Ruwenzori, Orchids, etc.

Singapore—Seeds of Palms, *Platyserium biforme*, etc.

Trinidad—Seeds of Palms.

Nairobi Forestry Department —*Encephalartos Hildebrandtii*, *Ansellia nilotica*, *Zamioculcas Loddigesii*, etc.

Donations from other sources include the following:

Mr. F. R. S. Balfour, Dawyck, N.B.—Various hardy trees and shrubs.

Mr. H. J. Elwes, Colesborne—Orchids, Nerines, and herbaceous plants.

Mr. M. T. Dawe, Director of Agriculture, Colombia—Collections of seeds.

Sir John Barran, Bart., Ripon—*Campanula Ephesia*.

Dr. G. V. Perez, Teneriffe—Seeds of Echiums, Genistas, etc.

Mr. J. C. Williams, Caerhays—Seeds of Chinese Rhododendrons, *Rosa sino-Wilsoni*, etc.

Booth Shipping Company, Liverpool—Palms from South America.

- Sir George Holford, Westonbirt—30 hybrid *Cymbidiums*.
 Mr. J. P. Leslie, Chatham—*Mesembryanthemum Lesliei*.
 Mr. T. W. Harker, Muizenberg, South Africa—Seeds of *Protea*.
 Mr. E. J. Harnett, Sydney—Seeds of Waratah (*Telopea speciosissima*).
 Mr. C. J. Lucas, Horsham—Various Orchids and tropical shrubs.
 Messrs. T. Rochford and Sons, Broxbourne—Large plant of *Psidium cattleianum* var.
 Lady Max Waechter, Richmond—Collection of Orchids.
 Lieut.-Col. Mainwaring, Trefnant—*Lonicera Griffithii*.
 Messrs. Wallace and Sons, Colchester—*Primula helodoxa*.
 Prof. A. Henry, Dublin—Seeds, *Larix olgensis*.
 Sir E. G. Loder, Bart., Leonardslee—*Rhododendron Loderi* var. King George, Conifers, and other trees.
 Hon. N. C. Rothschild, Oundle—Collection of Irises.
 Mr. I. B. Pole-Evans, Pretoria—*Aloe suprafoliata*, *A. aculeata*, and various seeds.
 Mr. G. Elisha, Canonbury Park—*Mesembryanthemums*.
 Miss A. Sich, Chiswick—Bulbs from Uganda.
 Mr. F. Monteith-Ogilvie, Oxford—Large plant of *Epidendrum prismatocarpum*.
 Mr. H. G. Mackie, Buenos Aires—Seeds of *Quebrachia Lorentzii*.
 Mr. B. C. Aston, Wellington, N.Z.—Seeds of New Zealand plants.
 Messrs. Bees, Liverpool—Seeds from China and the Himalaya.
 Mr. R. A. Nichol, Wellington, N.Z.—*Ranunculus Lyallii*.
 Mr. A. E. Bowles, Waltham Cross—Herbaceous plants.
 Duke of Northumberland—*Alnus Schmidtii*.
 Mr. W. Fox, Kingston—Orchids and Aroids from the Seychelles.
 Mrs. Woodward, Arley Castle—*Paeonia Woodwardii*.
 Mr. W. O. Milner, Totley Hall—Seedlings of *Primula Winteri*.
 Mr. T. F. Cheeseman, Auckland, N.Z.—Seeds of *Rhopalo stylis Cheesemanii*.
 Mr. H. Takeda, Japan—Seeds of *Glaucidium palmatum*.
 Mrs. Waterhouse, Halifax—Large plant of *Todea superba*.
 Mr. W. Cooke, Honda, Colombia—Seeds of *Posoqueria Cookei*.
 Mr. J. Clissoldy, Paryahyba, Brazil—Seeds of *Pilocarpus Jaborandi*.
 Mr. S. Stuart, Alaska—Seeds of Alaskan plants.
 Mr. T. H. Lowinsky, Tittenhurst—Large *Rhododendrons*.
 Hon. Vicary Gibbs, Aldenham—Various trees and shrubs.
 Countess of Selborne—Seeds of *Meconopsis* sp.
 Mr. Scoresby Routledge, Bursledon—Seeds of *Sophora Toromiro*, etc., from Easter Island.

Among the purchases made were orchids and other plants at the Red Cross Sale arranged by the Royal Horticultural Society;

specimen Filmy Ferns from the collection of the late Mrs. Waterhouse, Halifax, and a set of *Odontiodas* from Messrs. Charlesworth and Co., Hayward's Heath.

Surplus plants were distributed to various botanical gardens and public parks, and there was the usual distribution of seeds that had been saved during the year from the cultivated plants in the gardens. The total number of packages thus distributed was 2116 hardy herbaceous, and 1420 hardy trees and shrubs.

The most important of the seeds specially distributed were those of *Quebrahia Lorentzii* from the Argentine, a large forest tree, the wood of which is imported into this country and the United States for tanning purposes; *Aesculus indica*, the Indian horse chestnut; *Acanthoscyos horrida*, the African Narras; *Telopea speciosissima*, the Waratah; and *Sophora Toromiro*.

Surplus trees and shrubs were sent to Kneller Hall and other military stations, as well as to various Red Cross hospitals; also such bedding and herbaceous plants as could be spared after the planting at Kew.

Collections of plants were contributed from Kew to the Red Cross Sale held in the Horticultural Hall in June.

Arboretum.—The reduction of the staff has made it impossible to attempt much more than keep the grounds in order during 1916. At times even this proved more than could be done satisfactorily. The hay crop was unusually heavy, and this, combined with showery weather and inexperienced help, made its ingathering long and tedious. The consequence was that, by the time it was finished, weeds had got the upper hand, and the standard of cleanliness and order fell much below that of normal times.

More ground in the area of the collection of *Ericaceae* has been taken to provide for new Chinese rhododendrons, of which so many have been introduced during the last fifteen years. For the purpose, a mound close to the Holly walk and the *Arbutus* collection (H 7 on Key Plan) was cleared of a miscellaneous assortment of shrubs. A large oval bed was made, separated from which by a grass path are two long borders at the sides.

The storm of March 28th, 1916, is likely to be an historical one from the amount of damage wrought in London and the home counties. At Kew it will long be remembered on account of the destruction of the Sun Temple and the large cedar of Lebanon close by (see *Kew Bulletin*, 1916, p. 81). Since then, Kew has lost a tree of some note in the large red oak (*Quercus rubra*) which grew near the Pagoda. According to Elwes (*The Trees of Great Britain and Ireland*, V., p. 1245), this appears to have been in girth of trunk the third largest in the kingdom. Its upper growth was very much decayed and the occasional fall of large limbs made its removal necessary for safety. Its trunk measured 13 ft. 6 in. in circumference at 5 ft. from the ground and 17 ft. at the base, and the number of annual rings was about 170. It must, therefore, have been planted when Kew Gardens were the property of Frederick, Prince of Wales, the father of George III.

The Assistant Curator has visited and advised as to the treat-

ment of grounds and plantations attached to the following public institutions: Admiralty House, Portsmouth Dockyard; the Borsal Institute, Feltham; Kneller Hall, Twickenham. Trees and shrubs also have been supplied to the last named, to H.M. Training Depot at Osterley Park, the Red Cross Hospital, Richmond, and to Plymouth Corporation. Specimens of timber of various trees were supplied for experimental purposes to the Anti-Gas Department, R.A.M. College, London. Cuttings of *Populus Eugenei*—one of the most promising of quick-growing timber trees—have been distributed for trial to a number of private and public establishments. A number of species of *Rubus*, new and old, were sent to Mr. W. F. M. Copeland, of Southampton, who is making extensive trials in breeding and hybridising with a view to the production of new fruit-bearing kinds.

Additions to Tree and Shrub Collections.—An interesting gift to Kew made last autumn was a plant of *Cotoneaster integerrima*, Medic. (*C. vulgaris*, Lindl.). It was collected by the late Rev. Augustin Ley, a well-known British botanist, on Great Orme's Head in Carnarvonshire, and presented by his cousin, Miss Sibyl B. Gee, of Brampton Lodge, Herefordshire. This is the only species of *Cotoneaster* indigenous to the British Isles, and the only site on which it has been found is Great Orme's Head. It was originally discovered on the cliffs near Llandudno, then a small fishing hamlet, by Mr. J. W. Griffith in 1783.

During the year two consignments of trees and shrubs have been received from the Arnold Arboretum, including some new species of American *Aesculus* (a subject of recent study by Prof. Sargent), also new hickories, maples, birches, alders, and oaks. A number of plants collected by Dr. C. K. Schneider in China were included, most of them under numbers; a considerable proportion of these may prove new to science. Lt.-Col. F. R. S. Balfour sent from Dawyck about three dozen plants which had been noted as desirable for Kew. Col. Balfour has been endeavouring to introduce the interesting beech, *Nothofagus Dombeyi*, from Southern Chile. Seeds he sent to Kew were all, unfortunately, dead on arrival, but we learn that, out of a consignment of young trees, he hopes to save two alive. These may prove sufficient to establish this fine tree in cultivation.

From Mr. J. C. Williams, of Caerhays Castle, now the recognised headquarters of cultivated rhododendrons in Europe, several valuable contributions to this genus have been received. We have also to acknowledge gifts from Sir Edmund G. Loder, Miss Jekyll, Prof. A. Henry, and the Hon. Vicary Gibbs. To the deep regret of all who knew him, Canon Ellacombe died in February, and thus the garden of Bitton Vicarage, for the first time for very many years, makes no claim to our acknowledgments.

The United States Department of Agriculture sent, amongst other things, the very rare *Aesculus Wilsonii*, a new horse chestnut from Western China.

The following new trees and shrubs have flowered at Kew during the past year:—

Acanthopanax setchuenense.

- Berberis atrocarpa*.
 „ *Beaniana*.
 „ *Edgworthiana*.
 „ *Tischleri*.
Ceanothus sanguineus.
Clematis Spooneri.
 „ *x verrierensis*.
Disanthus cercidifolia.
Gaultheria pyroloides var. *cuneata*.
Hydrangea xanthoneura.
 „ „ var. *glabrescens*.
 „ „ var. *Wilsonii*.
Indigofera amblyantha.
 „ *pendula*.
Lonicera longa.
Magnolia conspicua var. *purpurascens*.
Prunus tenuiflora.
Pyracantha Gibbsii.
 „ *crenulata* var. *Rogersii*.
Rhododendron auriculatum.
 „ *haematodes*.
 „ *oreotrephes*.
 „ *rotundifolium* (*orbiculatum*).
 „ *Williamsianum*.
Rosa elegantula.
 „ *fasciculata*.
 „ *floribunda*.
Viburnum brevipes.
Vitis pulchra.
Wistaria venusta.

Museums.—During the past year no very considerable additions have been made to the permanent collections and but few duplicates have been available for distribution. A large number of miscellaneous products were received for determination from scientific institutions and commercial firms, and much general information has been given in this direction. As in the previous year, medicinal plants, oil seeds, food grains, and timbers have formed the bulk of the enquiries. Several changes have been made in the already depleted staff, but nevertheless much has been done to improve the collections, and a large number of products have been relabelled and otherwise improved. Although it has not been found possible to open to the public all the Museums, the closed buildings have been made available to about 200 individuals for special study.

A small room attached to the North Gallery, formerly used by Miss Marianne North as a studio, has been redecorated for the reception of Sir Arthur Church's collection of Botanical Drawings (see *Kew Bulletin*, No. 6, 1916, p. 162).

Presentations to Museums.—The following miscellaneous

specimens have been received in addition to those previously recorded in the *Bulletin*:—

Director, Botanic Gardens, Singapore.—Samples of wood of *Agathis robusta*, *Araucaria excelsa*, *Albizzia odoratissima* and *Cedrela Toona*.

Mr. M. T. Dawe, Director of Agriculture, Colombia.—Various specimens of fibre of Fique (*Furcraea gigantea*), see *Kew Bulletin*, No. 7, 1916, p. 169; series of carvings in the wood of *Spondias lutea*, and sample of bark-cloth of *Brosimum* sp. worn by the Indians of Manaos.

Messrs. Wigglesworth and Co., London, E.C.—Flax fibre from British East Africa.

Mme J. Pechat, Paris.—Ornamental door-knobs made of the crushed and compressed seeds of the Palmyra Palm (*Borassus flabellifer*).

Miss M. G. Downward, Richmond, Surrey.—A collection of West Indian Woods.

Mr. G. Farmer, Mombasa.—Photograph of Cocoanut Palm showing abnormal growth and of the Cocoanut Beetle (*Oryctes rhinoceros*).

Colonel Stephenson Clarke, C.B., Cuckfield, Sussex.—Transverse section of stem of *Pyrus torminalis*.

Messrs. Thomas and Green, Ltd., Wooburn, Bucks.—Sample of paper manufactured from reeds of *Phragmites communis*.

H.B.M. Consul-General, Buenos Aires.—Seeds of Quebracho (*Quebrachia Lorentzii*).

Mr. C. E. J. Esdaile, Taunton.—Plank of *Pinus insignis*.

Sir Daniel Morris, K.C.M.G., Boscombe, Hants.—Cones of *Pinus Pinaster* partially consumed by squirrels.

Mr. E. H. Man, C.I.E., Preston Park, Brighton.—1. Tôgo-chônga," or ornamental wristlets worn by young men at dances, etc. Made in part of immature leaf of *Pandanus* sp., the skin of *Dendrobium secundum*, fibre of *Anaden-drum paniculatum*, and portions of *Dentalium octogonum*. South Andamans. 2. "Ok-ho," or bark-cloth made from the bark of a species of *Ficus* used for clothing, wrappers, etc. Great Nicobar. 3. Skin of an orchid (*Dendrobium secundum*, South and Little Andaman).

Professor F. W. Oliver, F.R.S., University College, London.—Paper manufactured from *Spartina Townsendii* collected in Poole Harbour.

Mr. L. Fosbrooke, Ashby-de-la-Zouch.—Plank of Fulham Oak (*Quercus fulhamensis*).

Mr. C. H. Scriven, Thong, Gravesend.—Photographs of a large Yew Tree at Melliker, Meopham, Kent.

Mr. Alfred Dobree, Buckingham Gate.—Photographs of various articles in silver designed from fruits, leaves, etc.

J. M. H.

Research in Jodrell Laboratory in 1916.—Mr. J. Bintner examined cuttings of several species of plants in relation to the development of callus-tissue.

Mr. L. A. Boodle made experiments on the maceration of

plant-fibres, and studied the anatomical structure of a number of plants.

Miss T. L. Prankerd was engaged in a research on geotropic irritability in Ferns.

Miss F. M. Scott investigated the anatomy of the stem of a species of *Aegialitis*, and carried out some other anatomical work.

Mr. H. Takeda made observations on some Freshwater Algae, and completed his study of a species of *Chlamydomonas*.

Mr. W. C. Worsdell studied a number of teratological specimens in relation to their morphological nature, and examined the anatomy of *Polygonaceae*, etc.

Pathology.—In spite of war conditions the amount of material sent during the past year to the Pathological Laboratory for examination and report showed no falling off over 1915. The fungus *Ophiobolus graminis* produced, in various parts of the country, blindness in wheat, and such blind ears especially were attacked by *Cladosporium herbarum*, and these were submitted in quantity during the wet weather in September. Some bad cases of Black-leg in potatoes were investigated during the summer, and this malady together with "Leaf Roll" was very prevalent in the plot of "King Edward VII." in the experimental ground. *Rhizoctonia violacea* was found to be causing serious trouble in mangels in the south-west of England, and it appeared to be also more than usually frequent in other plants. The wet season was responsible for a very severe outbreak of *Phytophthora* on potatoes which had already suffered through a check received earlier in the season and caused by the drought in May. Revision and re-writing of the Board of Agriculture Leaflets also occupied a considerable amount of time.

Such routine work prevented much of the research which had been planned from being accomplished, but in spite of this, investigations on American Gooseberry Mildew, Wart Disease of potatoes, diseases of apples, figs, and other plants have been carried out, and some results already published.

Presentations to the Library during 1916.—In the Kew set of the six volumes constituting Sir J. D. Hooker's classical work, *The Botany of the Antarctic Voyage*, the plates of only two volumes—those devoted to the *Flora Tasmaniae*, and a few of the *Flora Antarctica*—are coloured. The library now possesses a copy of the latter *Flora* in which all the plates are coloured, and for this valuable presentation it is indebted to the Bentham Trustees. All the volumes of the work are now very scarce, but it is hoped that eventually it will be possible to replace the uncoloured copy of the *Flora Novae-Zelandiae* in the library by a coloured one. Volumes, or parts in continuation of numerous periodicals, received in exchange for *Hooker's Icones Plantarum*, have also been presented by the Bentham Trustees.

From the Secretary of State for India the following have been received :—The first part of a *Flora of the Presidency of Madras*,

by J. S. Gamble (a copy of which has also been presented by the author), *A Manual of Elementary Botany for India*, by R. B. K. Ranga Aclari, and further issues of the *Madras Presidency College Botanical Bulletin*, containing Prof. Fyson's figures and descriptions of Madras Plants.

The Under-Secretary of State for Egypt has presented eleven bulletins of the Technical and Scientific Service of the Ministry of Agriculture, Egypt, and a *Report on the great invasion of Locusts in Egypt in 1915*.

The Trustees of the British Museum have presented the *Report on Collections of Natural History made in the Antarctic Regions during the Voyage of the "Southern Cross,"* and the two volumes of the *Catalogue of the Mesozoic Plants in the British Museum: The Cretaceous Flora*, by Dr. Marie Stopes.

From Lady Church have been received a complete set of the *Dictionary of the Economic Products of India*, by Sir G. Watt, *Indian Art at Delhi*, 1903, by the same author, and a volume of *Technical reports and scientific papers*, edited by W. R. Dunstan; from Lady Hooker, the continuation of the *Comptes Rendus des Séances de l'Académie des Sciences*, Paris; and from Miss Alice Eastwood, the weekly issues of *Science* for the year.

From Sir Frank Crisp, Bart., have been received a copy of P. C. van Gél's *Sertum Botanicum*, published in Brussels in 1828 to 1832, and a complete set of the *Dictionnaire iconographique des Orchidées*, by A. Cogniaux and A. Goossens.

Sir W. T. Thiselton-Dyer has presented a number of pamphlets, a large collection of notes, cuttings, etc., relating to the history of the Royal Botanic Gardens, Kew, photographs of plants of special morphological interest, and a volume of manuscript notes, with drawings, on his botanical lectures delivered at South Kensington for the Science and Art Department in 1873.

A German translation, apparently very little known, of Burchell's *Travels in the Interior of South Africa*, has been presented by Dr. W. Botting Hemsley. This was published at Weimar in 1822 and 1825, and is in two octavo volumes, forming part of the *Neue Bibliothek der wichtigsten Reisebeschreibungen*, edited by F. J. Bertuch. Only one of the plates issued in the original work appears with the translation, and the Latin diagnoses of plants and animals are omitted. The copy now acquired formerly belonged to Burchell himself, and is in excellent condition. Dr. Hemsley has also presented *Unpublished Documents on the History of the Seychelles Islands anterior to 1810*, etc., by A. A. Fauvel.

Prof. Hans Schinz has supplied the library with further numbers of the *Mitteilungen aus dem botanischen Museum Zürich*, No. 70 of which consists of the second part of *Die Flora des Val Onsernone*, by J. Bär. Other contributions from Prof. Schinz are:—*Die Vegetationsverhältnisse des Pflanzenschonbezirktes bei Berchtesgaden*, by K. Magnus, and *Weitere Beiträge zur Kenntnis der Wirkung von Bakterien auf Gemüsekonserven*, etc., by G. Rudolph.

Prof C. S. Sargent has sent four more parts of the *Plantae Wilsonianae*, which has now reached the second part of vol. iii.,

and E. H. Wilson's monograph, *The Cherries of Japan*; also a copy of a facsimile reprint of a *Catalogue d'Arbres, Arbustes et Plantes Herbacées d'Amérique*, by William Young, Jr., originally published in Paris in 1783; this reprint, which is furnished with an account of the author and critical notes, has been edited by S. N. Rhoads.

The Subantarctic Islands of New Zealand:—Reports edited by C. Chilton, and *Index Faunae Novae Zealandiae*, edited by Captain F. W. Hutton, have been received from the Philosophical Institute of Canterbury, New Zealand; and a bound volume of the *Reports of the Botanic Gardens and Domains, &c.*, Sydney, 1896-1914, from their author, Mr. J. H. Maiden, who has also presented the continuation of his Critical Revision of the Genus *Eucalyptus*, and two copies of a *Census of New South Wales Plants*, compiled by himself and the late Mr. Ernst Bêche.

A selection of the numerous publications of the United States Department of Agriculture have been received from the Secretary of Agriculture, Washington, those of the Department of Agriculture in the Dutch East Indies, the continuation of the *North American Flora*, published by the New York Botanical Garden, and the first part of the *Archivos do Jardim Botânico do Rio de Janeiro*, from the Directors of the respective establishments.

Other contributions to the library, received from their authors or publishers are:—*The Standard Cyclopaedia of Horticulture*, by L. H. Bailey, vols. iv. and v.; *Marine Algae of the Danish West Indies*, by F. Börgesen, vol. ii. pt. 2; *Philippine Dipterocarp Forests*, by W. H. Brown and D. M. Mathews; *La Végétation de Paraguay*, by R. Chodat; *Lichenum Lusitanorum . . . Catalogus*, and other publications, by A. X. P. Coutinho; *A Hausa Botanical Vocabulary*, by J. M. Dalziel; *Third Annual Report of the Botanical Office . . . British Columbia*, by J. Davidson; *Jacob Georg Agardh: Minnesteckning*, by J. Eriksson; *A Glossary of Botanic Terms*, by B. Daydon Jackson, ed. 3; *Le Marchantiaceae della Flora Europea: Monografia*, and several pamphlets, by C. Massalongo; *Shokubutsu-me-i . . . Part 2: Japanese Names of Plants*, by J. Matsumura; *The Flora of the Bagshot District*, by H. W. Monckton; *Flora Sylvatica Koreana*, pts. 1, 2, 4, and 5, and a *Report on the Vegetation of Mount Waigal-bon, North Korea*, by T. Nakai; a second copy of the *Materials for a Flora of the Malayan Peninsula* [Monocotyledons], by H. N. Ridley; *The Genus Meliola in Porto Rico*, by F. L. Stevens; *Voorbereidende Onderzoekingen ten dienste van de Selectie der Theeplant*, by C. P. Cohen Stuart; and *The Flowering Plants of Africa*, by F. Thonner.

The following have also been received: *Quinze cents Plantes dans l'Inde*, by A. D. Achart, from W. C. Worsdell; *Sleeping Sickness . . . in Principe, Portuguese West Africa*, by B. F. Bruto da Costa and others, translated by Lieut.-Col. J. A. Wyllie, from the translator; *Notes on Nigerian Trees and Plants*, by E. W. Foster, and a *Report on the Afforestation of Togo . . .* by A. H. Unwin, from the Secretary, Southern Provinces, Nigeria; *Flora of the Carboniferous of the Netherlands and*

adjacent regions, vol. i., by R. Kidston and W. J. Jongmans, from Mr. Clement Reid; *Transactions of the Third International Congress of Tropical Agriculture*, vol. i., from the Organising Secretaries; *The Smuts of Australia*, by D. McAlpine, from the Government of Victoria; *Tratado elemental de Botanica adaptado al estudio de la Flora de la America equinoccial*, by C. C. Marquez, from Mrs. F. Tracey, and *Prehistoria y viajes* [including *Flora Colombiana*], by the same author, from Mr. J. M. Vargas Vergara; *Flora of Saghalin* (in Japanese), by K. Miyabe and T. Miyake, from the Governor; *Contribution a l'Etude du Genre Pulmonaria*, by P. Parmentier (type-written), from Mr. C. C. Lacaita; *La Science française*, a work in two volumes, published on the occasion of the International Exhibition, San Francisco, 1915, from the Director of the National Office of French Universities and Schools; and *The Genus Phoradendron: a monographic revision*, by W. Trelease, from the University of Illinois.

The establishment is indebted to authors, editors, and others for numerous publications which it is not possible to specify in this note, but a complete list of the additions to the library for the year 1916, whether obtained by presentation, exchange, or purchase, will form Appendix II. to the *Kew Bulletin*, 1917.

Additions to the Herbarium during 1916.—During the year about 12,000 specimens were received as donations or exchanges, in addition to two large Tropical African collections, and 8260 acquired by purchase. During 1916, 775 specimens were received on loan. The principal collections are enumerated below:—

EUROPE.—*Presented*: British seeds, by Messrs. T. A. Sprague and W. B. Turrill.

Purchased: Dr. J. W. Ellis, British Fungi. Dr. E. G. Gilbert, British Rubi. H. Sudre, Herbarium Hieraciorum, fasc. 5-6.

ORIENT.—*Presented*: Persian lichens, by Dr. O. Stapf.

ATLANTIC ISLANDS.—*Presented*: Tenerife, by Dr. G. V. Perez.

CHINA AND JAPAN.—*Presented*: Chekiang (F. N. Meyer), by the United States Department of Agriculture.

Purchased: China, E. H. Wilson and C. K. Schneider, and Japan, E. H. Wilson, through Prof. C. S. Sargent.

INDIA.—*Presented*: Madras, by the Madras Government Herbarium, through Mr. J. S. Gamble; Madras, by Mr. C. E. C. Fischer and Prof. P. F. Fyson; Gwalior, by Miss E. M. Saunders; Ceylon, by Mr. A. R. Venning; Andamans, by Mr. C. E. Parkinson, through Mr. R. S. Hole; Malay Peninsula, Kedah Peak, by Messrs. H. C. Robinson and C. Boden Kloss, through Mr. H. N. Ridley; Malay Peninsula, various, by Mr. I. H. Burkill.

MALAYA.—*Presented*: Siam, by Dr. A. F. G. Kerr, Khun Winit Wanadorn and Phra Vanpruk.

AUSTRALIA.—*Presented*: New South Wales, by Mr. W. Greenwood; Western Australia, by Dr. F. Stoward and (Dr. Alexander Morrison) by the Royal Botanic Garden, Edinburgh.

TROPICAL AFRICA.—*Presented*: Sierra Leone, by Messrs. C. E. Lane-Poole and K. Burbidge; British East Africa, by Mr. W. J. Dowson; Uganda, by Messrs. R. Fyffe and R. A. Dummer; Nyasaland, by Mr. J. M. Purves; Rhodesia (Mr. A. J. Teague and the Rev. F. A. Rogers), by the Bolus Herbarium; South-West Africa, by Dr. Hans Schinz.

SOUTH AFRICA.—*Presented*: Percy Sladen Memorial Expedition, Keepmanskop to Windhoek, 1915-16 (Prof. H. H. W. Pearson) and from various localities, by the Bolus Herbarium; Basutoland (Mrs. A. Dieterlen) and other localities, by the South African Museum; Matabeleland (Rev. F. A. Rogers), by the Bolus Herbarium.

Purchased: Kentani Fungi, Miss A. Pegler.

NORTH AMERICA.—*Presented*: British Columbia, Dry Belt, by Miss E. M. Warren; United States and Canada, by Prof. C. S. Sargent; "American Grasses" cent. 3-4 (including some tropical specimens), by the United States Department of Agriculture.

Purchased: Collins, Holden and Setchell, Phycotheca Boreali-Americana, fasc. 42-43; G. W. Stevens, Oklahoma.

CENTRAL AMERICA.—*Presented*: Mexico, (Frères G. Arsène and Nicolas), by Prince R. Bonaparte; Socorro Island, by Mr. Scoresby Routledge.

WEST INDIES.—*Presented*: Various islands, by the New York Botanical Garden; Jamaica, by Mr. H. N. Ridley; Porto Rican Fungi, by Mr. F. L. Stevens.

SOUTH AMERICA.—*Presented*: Colombia, by Mr. M. T. Dawe and Mrs. F. Tracey; Patagonia, by Mr. Scoresby Routledge.

Dr. E. G. Gilbert's collection of British Rubi consists of more than 1000 sheets, representing many critical forms of which he had made a special study. Dr. G. V. Perez has continued to send critical species from Tenerife. Three important collections of Chinese plants have been acquired, one made in Chekiang by F. N. Meyer and received through the U.S. Department of Agriculture, the others made by Mr. E. H. Wilson and Mr. C. K. Schneider respectively were forwarded by Prof. C. S. Sargent, from whom also Wilson's Japanese collection has been obtained. Plants from the Madras Government Herbarium have been presented through Mr. J. S. Gamble, who is working out the "Flora of Madras." The plants collected by Messrs. H. C. Robinson and C. B. Kloss on Kedah Peak have been worked out at Kew by Mr. H. N. Ridley, whose report on them, with descriptions of new species, has been published in the *Journal of the Federated Malay States Museums*, vol. vii. pp. 37-58. Mr. I. H. Burkill has sent, amongst other things, specimens of Dioscoreas cultivated at Singapore. Dr. A. F. G. Kerr continued to send Siamese plants until he left Siam for service as an officer

of the Royal Army Medical Corps. Dr. F. Stoward has contributed additional material from Western Australia, and further consignments of the late Dr. Alexander Morrison's collection from the same region have been presented by the Royal Botanic Garden, Edinburgh. Mosses from New South Wales have been received from Mr. William Greenwood. Tropical Africa, as has been the case for some years, has furnished a large amount of material; in addition to that received from regular correspondents, a large collection has been received from German East Africa and another has been obtained from the Cameroons. Dr. Hans Schinz has presented an interesting collection of varieties of *Sorghum* from South-West Africa. Specimens collected by Prof. H. H. W. Pearson and others during the various Percy Sladen Memorial Expeditions in South Africa have been presented by the Bolus Herbarium. West Indian plants collected by Dr. N. L. Britton, Mr. W. Harris, and others have been presented by the New York Botanical Garden. Mr. H. N. Ridley has presented a set of the plants collected by him last winter in Jamaica. Mr. M. T. Dawe, Director of Agriculture, has sent many specimens collected during his tours in Colombia. Mr. Scoresby Routledge has presented the specimens collected during his cruise to Southern Patagonia, Socorro Island and Easter Island. In addition to dried specimens, a set of 293 water colour drawings of orchid flowers from the collection of Mr. J. Leemann was purchased at the Royal Horticultural Society's Red Cross Sale.

Black Rust of Wheat.—Prof. A. H. Reginald Buller, Professor of Botany, Winnipeg, sends us the following particulars as to the destruction of wheat in North America due to Black Rust: "The Black Rust has done enormous damage to our wheat crop in Canada and the United States. I have carefully looked into the figures at the Winnipeg Grain Exchange. Early in July, the wheat estimate for this year's crop was from 275 to 300 million bushels; the estimate now is between 150 and 175 million bushels. It is well within the mark to say that this year the depreciation of the wheat crop, owing to the attacks of rust, has been not less than 100 million bushels. This loss is that suffered in our three prairie provinces of Alberta, Saskatchewan, and Manitoba. In the Central States of the United States of America, such as the Dakotas and Minnesota, the loss has been equally great. The poor Wheat crop in North America is affecting the War, for the British Government is having to send to Australia for supplies and thus using up tonnage which might otherwise have been free. The Rust Fungus is thus once more demonstrating that it can be a feature of high political and social importance."
